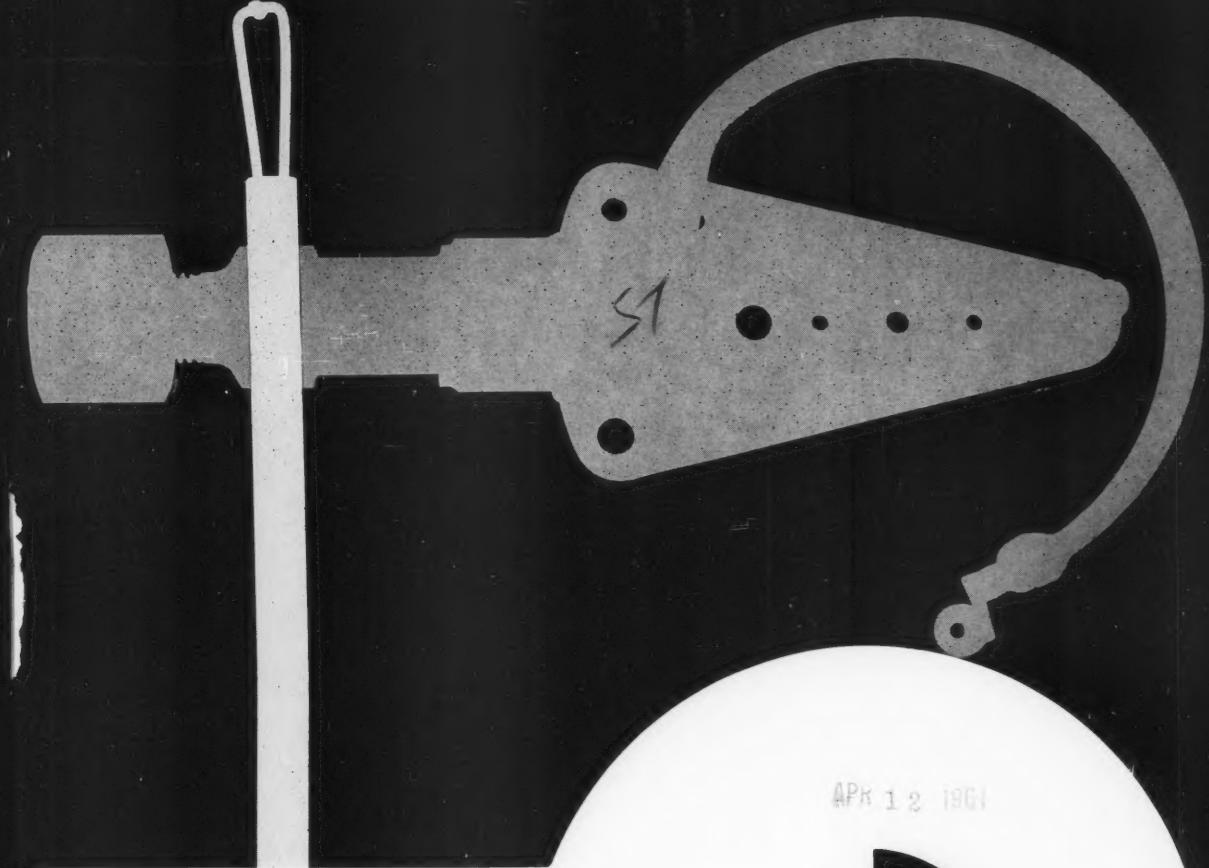


Design Engineering

FIVE DOLLARS A YEAR, PUBLISHED BY THE MACLEAN-HUNTER PUBLISHING COMPANY LIMITED, TORONTO, CANADA

APRIL 1961



The application of
instruments and controls

APR 12 1961

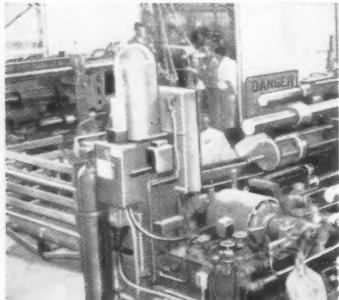


New Facilities for aluminum die-castings

Modern, precision equipment at Hoover assures top quality and fast delivery

New operational methods and facilities enable Hoover to offer a die-casting service that is second to none. This expansion is reflected throughout the entire Casting Division.

From design-engineering to final inspection the emphasis at Hoover is on modern methods, efficient equipment and careful craftsmanship.



Hoover's die-casting section (above) has machines with ratings up to 600 tons, that can produce aluminum die-castings in quantity from the smallest practical size up to 14" x 14".

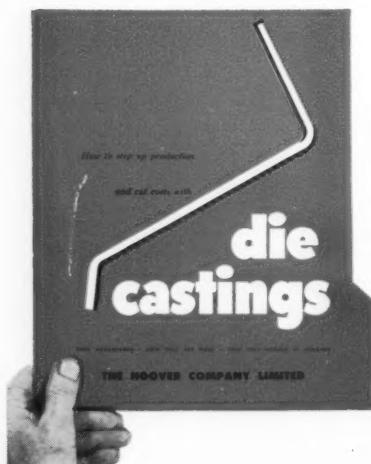
Trimming, finishing, buffing, machining and painting facilities (partially pic-

tured below) enable Hoover to deliver castings in every state of finish, from "as-cast" to the finest commercial surfaces.

Scientific sampling and thorough testing of finished castings assure consistently high quality and strict adherence to specifications.

When should die-castings be used? There is no simple answer to this question. Generally speaking, die-castings should be used when reduced machining costs, intricate shapes, economy, attractive appearance and durability are factors.

Contact Hoover Die-Casting Division to learn if this precision technique will cut your costs.



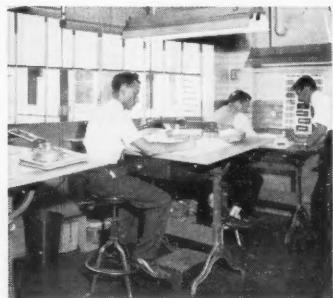
Send for this FREE DIE-CASTINGS HANDBOOK

This informative bulletin on aluminum die-casting will guide you in choosing alloys, and in the design of castings. Hints are included to help you take advantage of the die-casting process. You will also be interested in a detailed picture story that traces the production of die-castings from drawing board to final inspection. Write to

HOOVER
Die-Casting Division,
Hamilton, Ontario

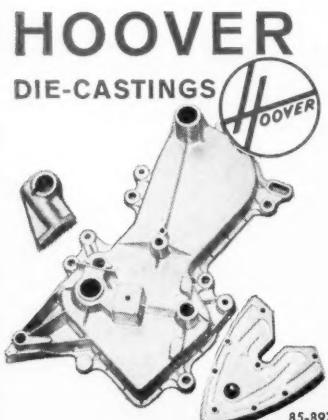
HOOVER

has the
DIE-CASTING
know-how

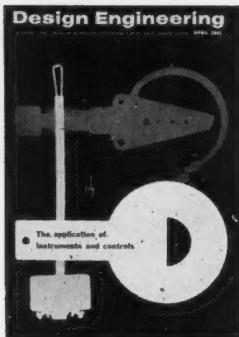


to produce
castings at
lowest costs

Hoover engineers have a tremendous fund of specialized experience in die-casting. Their knowledge is at your disposal. They welcome the opportunity to discuss your die-casting problems, and to assist in the design of components that will cut your costs and improve your product.



85-897



This month's cover

When Ron Vickers, ARPS, our cover photographer, gets an idea it's usually a good one. This month he set out to depict instrument components that would be recognizable in silhouette . . . with the emphasis on pressure, temperature and flow. He came up with this photogram . . . where the parts were laid directly on photo-sensitive paper, and the positive developed direct. Varying periods of exposure were used to obtain the different tones of grey. As Ron told us "If they're a little out of line you will have to forgive me . . . after all, I was working in the dark." Credit goes to Honeywell Controls Limited for loan of the gauges.

In this issue

- 47 **Can you define process control terms?** **Roy Horney B.A.**
Here is a simple memory guide to help you understand the terms used in process control and instrumentation.
- 50 **Canadian design scoops the world** **George Hayhurst P.Eng.**
How a Canadian firm won a contract to design a memory unit for a U. S. defence network in face of world-wide competition.
- 54 **Time cycle charts . . . save time and effort** **G. G. Siposs P.Eng.**
This is a first hand account of the advantages of using time cycle charts as an aid to designing with instruments.
- 57 **Now . . . ready-made computer programs**
How much time do you spend on stress-analysis of elastic shells? Today you can use a ready-made computer program.
- 58 **Not enough instrument engineers—why?** **Doug Kaill P.Eng.**
It's almost unthinkable that Canada is so short of technologists in one of today's most promising fields.
- 62 **Engineering design with computers** **D. R. Best B.A.Sc.**
In the modern world of automation the tedious chore of solving process control problems can now be delegated to a computer.
- 65 **Designing for instrument motor lubrication**
A panel of experts outlines the design requirements for lubricating motors in instrument applications.
- 67 **New controls for automation in the home** **Don Weekes**
Methods used in automating home appliances could possibly have an application to some of your products.

Departments

Backlash	88
Briefs	73
Contributors	3
Designews in pictures	60
Designers' bookshelf	78
Editorial	90
New Products	81
Overheard in Ottawa	84
People and events	76
Reader Service Card	91
Reports	5
Technical Literature	71

Reader Service

Before reading further, turn to the back of the book and tear out a Reader Service Card. Circle the numbers as you go and mail the completed card to us—no postage is required. We will take care of your requests immediately.

Pass your copy along so that others may enjoy this service—there are three cards.

Plan now to attend . . .

... Canada's first automation show

Hear interesting and informative speakers . . . meet the world's leading suppliers . . . greet your friends . . . at the first show of its kind to be held in Canada . . . turn to page 53 for complete details

CNE Grounds

Toronto, Canada

June 5-8



There's no end of possibilities with

STEEL TUBING
by STANDARD TUBE

STANDARD TUBE
STANDS FOR
ALUMINUM TOOL
Sheet, Bar, Extrusions,
Tube and Wire—avail-
able in any quantity.



STANDARD TUBE AND T.I. LIMITED

WOODSTOCK - HAMILTON - TORONTO - OTTAWA - MONTREAL - VANCOUVER
AGENTS IN OTHER PRINCIPAL CITIES

For further information mark No. 161 on Readers' Service Card

The staff

A. Douglas Kaill
B.Sc., M.E.I.C., P.Eng.
EDITOR

Tony Stevenson
ASSISTANT EDITOR

Gordon Duffy
MONTREAL EDITOR

Richard Gwyn
OTTAWA EDITOR

Robert A. Metcalfe
BRITISH COLUMBIA EDITOR

Raymond A. Tulloch
MANITOBA EDITOR

George McKechnie
ADVERTISING REPRESENTATIVE

Charles E. Laws, B.J.
EASTERN REPRESENTATIVE

J. A. Walters
U. K. ADVERTISING MANAGER

Frank Davies, M.T.D.C., M.S.I.A.
EDITORIAL ART DIRECTOR

John F. Foy
CIRCULATION MANAGER

J. W. Sargent
MANAGER, ADVERTISING PROMOTION

W. A. Weir
ADVERTISING SERVICE MANAGER

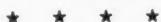
D. van Rij
ADVERTISING PRODUCTION

Murray Mark
MANAGER, VANCOUVER OFFICE

Ronald A. Smith
MANAGER

George W. Gilmour
GROUP MANAGER
INDUSTRIAL PUBLICATIONS

J. L. Craig
VICE PRESIDENT AND DIRECTOR
BUSINESS PUBLICATIONS DIVISION



Design Engineering

MEMBER **CCAB**

Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 481 University Avenue, Toronto 2, Canada. Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal 2; The Burrard Building, 1030 West Georgia Street, Vancouver 5; Maclean-Hunter Limited, 30 Old Burlington Street, London W.1, England.

Subscription rates: Canada \$6.00 per year; two years \$9.00; three years \$13.00. Single copy price, \$1.00. United States and Great Britain \$10.00 per year. Other countries \$20.00 per year.

Authorized as second class matter. Post Office Department, Ottawa.

The contributors

A professional engineer who spends his spare time paddling kayaks. That is **George Siposs** who did the feature on Time Cycle Charts. George works for Johnson, Matthey and Mallory designers and manufacturers of timer switches for automatic washing machines.

A married man with two children, we hesitated to ask his wife if she approves of his hobbies which are kayaks and sports cars (he built one himself). In fact George is president of the Ontario Voyageurs' Kayak Club. In spring when the rivers run high, club members undertake simple pastimes, like shooting rapids. George has taken part in several international competitions, including the 150 mile Fraser River race in B.C.—the test to end all tests for kayakers.



Siposs



Hayhurst



Weekes

George Hayhurst is no newcomer to the technical magazine field. A couple of years ago he was assistant editor of Modern Power and Engineering, succeeding DE's present editor, Doug Kaill in the post.

Born in Lancaster, England, George came to Canada in 1952 after a stint in the Royal Air Force. He has had experience as a draftsman, mechanical engineer and product engineer, and at present is head of the planning department at Ferranti-Packard Electric Ltd., Toronto. His article this issue discusses the company's memory unit.

Married with two sons, George enjoys making his own furniture and keeping his garden in trim. He has just returned from a vacation in the Old Country.

Don Weekes, who authored the article on controls, is staff technician of Robertshaw-Fulton Controls (Canada) Ltd. Born at Smiths Falls, Ontario, he was a wireless operator in RCAF air crew during the war, serving in Newfoundland and other parts of eastern Canada. He joined Robertshaw-Fulton in 1954 and was appointed to his present position in 1959. He is a member of several sub-committees of the Canadian Gas Association and the Canadian Standards Association.

In summer Don spends weekends at his cottage at Haliburton where he likes fishing, boating and swimming. In winter-time he has a hobby more closely allied to his every-day job: electronics.

Although **Roy Horney** teaches a highly technical subject during his working day, he likes to relax at home by patching up old radio and TV sets, when his family (he has three daughters) permits him the time. A graduate in physics and mathematics from University of Toronto, he is

now Director of Instrument Technology at Ryerson Institute, Toronto.

He joined Ryerson about ten years ago after teaching high school in the Ottawa district. Today he instructs a course in process control theory and has done post-graduate work in the subject at Case Institute of Technology, Cleveland. In this issue of DE he writes on instrument terminology.

Roy's tastes in sports are also technically oriented. He coaches the Ryerson team in a game generally regarded as highly scientific—soccer.

Don Best, author of the article on computers, became an engineer because he thought it would pay better than an artist. He still paints in his spare time, but today he's an engineering executive who feels he made the right decision.

After a year as instrument mechanic with Bristol Company of Canada he entered University of Toronto to study mechanical engineering. On graduation in 1950 he rejoined Bristol in instrument sales and service. When Daystrom Ltd. began business in Canada he was made Montreal branch manager, and is now sales manager, industrial products, at Toronto head office.

Apart from oil painting, Don is a keen woodworker. Being married with two daughters he finds plenty of opportunities to ply his hobby, even down to building a house. ★



The Bellows Air Motor® Makes Pneumatic Circuits Easier to Design • Easier to Build

The Bellows Air Motor makes designing for air operation a lot easier and less costly. Its built-in directional valve, built-in speed controls, and its single air connection (which can be flexible hose) is true space-saving design—makes it fit perfectly in cramped quarters or on moving machine elements. And from the standpoint of final design, the Bellows Air Motor offers faster action, more positive control, and minimum maintenance.

The Bellows Air Motor is available in various mounting styles, in five bore sizes (1½", 1¾", 2½", 3⅝" and 4½"), and in any stroke length. Optional built-in valves include 8-12v low voltage control, 115v JIC electric control, manual or pneumatic controls, thus giving the design engineer the widest latitude in control systems.

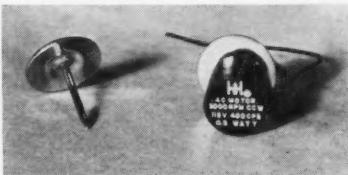
Full data on Bellows Air Motors is in Bulletin BM-25, free on request. Write Dept. DE-461, Bellows-Valvair Ltd., Toronto 18, Ontario.

Bellows-Valvair, LTD.
14 Advance Road Toronto 18, Ont.
SUBSIDIARY OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

Reports — A world roundup of engineering and design interest

Miniaturization advances with world's smallest timing device

A lilliputian motor, worth twenty times its weight in gold, is the power source for equally small elapsed time indicators and repeat cycle timers. Small enough to be hidden behind an ordinary thumbtack, the 115 volt, 400 cps single-phase hysteresis-type motor measures $\frac{1}{8}$ inch in diameter by $9/32$ inch in length. It consumes less than one-half watt of power. The torque of the motor is rated 1.5×10^{-6} hp, or 0.0005 inch-ounces. While the motor will have a number of applications, it was specifically designed to power a hermetically sealed repeat cycle timer. This one-ounce timer can be used in airborne computers to pulse or program circuits, or in conventional timer applications, as for telemetering, or any use utilizing a time base. *Source: Philips Electronics Industries Ltd.*



Circle 301 on Reader Service Card

More corrosion resistance built into this new stainless

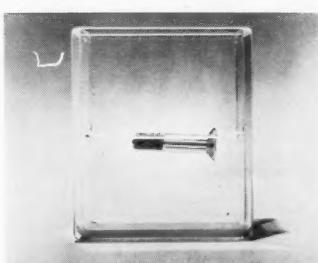
A new and even more corrosion resistant stainless steel has been developed after two years of intensive development work. It is expected that the new alloy will be used initially in the automotive industry for which it was developed. However, other industries, such as architectural, furniture and appliance, will also be interested. The new alloy will be designated type 433 and has additions of molybdenum and copper to the automotive standard stainless steel of type 430. Patents have been applied for on the new grade. *Source: Allegheny Ludlum Steel Corporation.*

Circle 302 on Reader Service Card

Beryllium makes the grade in high-strength bolt applications

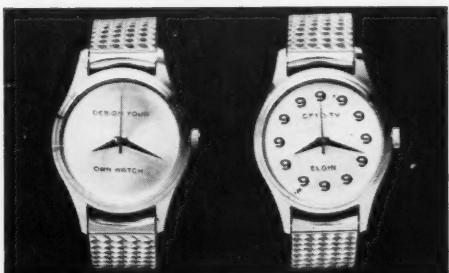
The strongest metal fasteners for their weight ever produced are now being made of beryllium metal. This development opens up immediate weight-savings possibilities in space, aircraft and missile craft where bolts are used, and also points the way to more successful use of the featherweight wonder metal in other structural components. A highlight of the development program was the isolation of the real source of much of beryllium's structural troubles to date—its notch sensitivity. Whereas most investigators have attributed the metal's restricted performance to an inherent general brittleness, tests showed that it was a certain type of brittleness—a sensitivity to notches or surface discontinuities—that was the specific cause. The newly designed beryllium bolts have a shear strength that is equivalent to a steel bolt with something over 260,000 psi minimum value. An unusually large and rounded root in the thread (1.5 to 2.5 times that of conventional threads) helped to achieve the superior strength. *Source: Standard Pressed Steel.*

Circle 303 on Reader Service Card



Design your own watch, says Canadian company

A unique "design your own watch" concept has been offered to the Canadian public. You can have practically anything you want inscribed on the face of your watch with this new program. Multicolor logotypes and trademarks can be reproduced, facsimile signatures can be included. It is expected the idea will increase sales of watches to manufacturers, service clubs, sporting and social clubs—or any other group which desires its own exclusive watch. Sounds like an excellent idea—and one that could be adopted readily by industrial designers for application to many other products sold on the consumer market. *Source: Elgin Watch Company.*



Circle 304 on Reader Service Card

New

LET THIS KIT
INTRODUCE YOU TO
"POP"[®]
RIVETS

"POP" RIVET KIT
For developing a better fastening system at lower costs.
Cuts installation costs in half.

"POP" Rivet—the fastener which is inserted and set from the same side.

What "POP" Rivets are:
How to use:
How to make:
How to work:

UNITED POP RIVETS

**It Can
SAVE
Your
Company
Thousands
of Dollars!**

\$ 19.95
ONLY
PREPAID

Management men seeking a better, quicker and less expensive way to fasten products will put this idea Kit to work now in their design and methods engineering departments . . . where it can prove what thousands of companies already know — that "POP" Rivets can save over 50% on installed rivet costs — improve quality, speed production.

With this Kit your design engineers can experiment with simplified product design, study vibration effects, clearances, or fastener appearance. Methods or production men can try assembly-line changes on the spot. Time study analysts can make direct installation comparisons.

Assembled as an inexpensive means of introducing management to the "POP" Rivet fastening system, this new Kit contains everything needed — instructions, rivet assortment, hand pliers for setting rivets, — plus idea material.

How "POP" Rivets Work. They're installed and set from one side. A hollow rivet is pre-assembled on a solid headed mandrel which is used to set the rivet. Mandrel head is larger than end of rivet. When the head is pulled into the rivet with setting tool, the mandrel head clinches the rivet. Mandrel breaks near head under tension when rivet is set. Both hand and production power tools are available.

"POP" RIVET DIVISION

United Shoe Machinery Company of Canada Limited
2610 Bennett Avenue, Montreal, Quebec

Attached find check purchase order

for..... "POP" RIVET KITS No. 100 @ \$19.95 prepaid

NAME TITLE

AFFILIATION

STREET

CITY ZONE .. PROV.

For further information mark No. 171 on Readers' Service Card



HELPS THE HAND
THAT SHAPES
THE FUTURE

CASTELL

#9000. The economical wood drawing pencil. Smooth, 100% grit-free, consistently uniform pencil after pencil.



CASTELL LOCKTITE

#9500. Press action drawing pencil with handy pocket clip. Takes full size lead.

TEKAGRAPH

#9603. The ultimate in precision lead holders. Perfectly balanced to eliminate drafting fatigue.

CASTELL LEADS

#9030. Matching #9000 exactly in quality and grading. Packed 6 to a plastic, re-usable container.

Creative men the world over in the fields of designing, engineering and drafting use and trust these precision tools. It costs so little to own the world's finest drawing instruments.

Castell pencils and leads draw perfectly on all surfaces, including Cronar and Mylar base films. Give graphite-saturated lines, easy to erase, no ghosting — excellent reproduction.

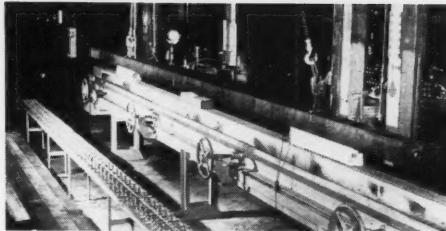
CARSEN INSTRUMENTS LIMITED

162 Bentworth Ave., Toronto 19, Ont.

For further information mark No. 119

New technique to fabricate finned heat transfer elements

A novel technique was used recently in the assembly of finned heat transfer elements. The elements, used in the economizer sections of steam generators, were assembled by expansion with hydraulic pressure from a hydropneumatic pump. The trick in assembly was to get a tight fit between the fins and the outside of the tube. Usually the fabricator fastened the fins to the tube individually. Heated cast rings with collars attached were positioned on the tube and then shrunk in place with cold water. In the new technique, all 691 fins on the tube were assembled on the tube at one time. The tube was then expanded to lock the fins in place. Operating on an airline pressure of 80 psi, a hydropneumatic pump exerted a pressure to 24,000 psi to expand the tube. Fins were thus frozen in place. *Source: Aldrich Pump Company.*



Not all polyester types have same corrosion resistance

A report has just been released in the US which shows conclusively that the ability of a polyester to withstand corrosion depends upon the specific chemical structure of the plastic. The wide difference in the performance of these materials makes it vital for designers and fabricators of corrosion resistant equipment in the chemical processing, paper, textile, metal treating, and other fields to go through a careful evaluation before specifying a particular plastic for an application. One year test results showed that general purpose polyester should not be used where corrosion resistance is required, and that other polyesters should be checked carefully for applications involving certain acids. Copies of the report are available to any of Design Engineering's readers. *Source: Atlas Powder Company.*

Circle 305 on Reader Service Card

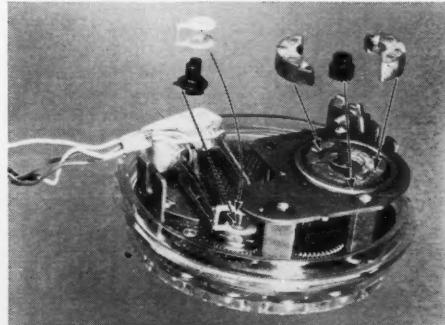
Obstructionless mass flow measurement system developed

Here's an idea that will make many a design engineer happy. If you're in the food industry, you can use it to control the direct stock weight flow to assure a consistent product. If you work with chemicals, you can utilize it where there is large density variation, to permit process control on a straight weight basis. The water and waste industry can use it for control of the consistency of sludge. It's a mass flow measurement system which is obstructionless, completely unaffected by viscosity, pressure, temperature or piping configurations. The system uses a magnetic flowmeter, a radiation density detector, and takes readings on a single chart recorder. *Source: Fischer & Porter.*

Circle 306 on Reader Service Card

Princess telephone handset uses die cast and molded components

To achieve the unique combination of compact design and light weight required for the new telephone handset, liberal use was made of small plastic moldings and die castings produced by automatic techniques. Consciously designed to appeal to women, the dainty package houses functional components that are precise, extremely rugged and dimensionally reproducible by mass production methods. Among the parts that are processed on the high-speed automatic production machines (at the rate of several hundred a minute) are the governor pinion, cam, pawl and critical dial parts. These parts are all important to the proper timing of the newly-designed dialing mechanism. A major factor in selecting materials for these components was their ability to withstand the wear and stress encountered in more than two million operating cycles — the standard performance test which simulates actual lifetime use. The functional improvement apparent in the new design gives reason to forecast that the telephone of the future will feature greater simplicity, reliability and operating efficiency. *Source: Gries Reproducer Corp.*





INSTRUMENTS . . .

INDICATING



SWITCHBOARD METER

AB-18—The AB-18 combines the advantages of long scale and compact design with an improved cover for shadow elimination. Invaluable for miniature switchboards, special test equipment, and all installations where space is limited.

BULLETIN GEC-1507



PANEL METER

DW-91—A compact panel meter that offers excellent readability, self-shielded dc core-magnet mechanism, and completely sealed case. Accurate to (plus or minus) 2% of full scale.

BULLETIN GEA-7034



CONTROL INITIATION

ON AB-18—This contactless Control-Initiating Instrument helps achieve effective control of all operations . . . and is adaptable to G-E long-scale instruments. BULLETIN GEC-1474

RECORDING



GENERAL PURPOSE RECORDER

CH—For charting a continuous record of an electrical quantity against time, various models of this recorder are available to measure a-c volts, amps, watts, vars and frequency, or d-c volts, amps, and millamps. Available in both ink or inkless version with electric motor or hand wound 60 day spring clock drive.

BULLETIN GEC-1319



INKLESS SWITCHBOARD & PORTABLE RECORDERS

CF—Has an operational temperature range of from -10F to 120F. The inkless feature and a 65-foot record roll give a month's continuous record at 1"/hr. chart speed with no maintenance.

BULLETIN GEA-6821



STRIP-CHART RECORDER

HG-HF—These Potentiometric servo-operated recorders are available as single point (HF) or multi point (HG) to measure variables with very close accuracy, and at the same time provide sufficient torque to operate a variety of control devices. BULLETIN GEA-6887

ROUND-CHART RECORDER

HR—Potentiometric recorder accurately measures variables to within (plus or minus) $\frac{1}{4}\%$. Unique design allows use of up to 8 on-off control switches front or back-set, or 4 switches, plus 4 transmitting side wires.

BULLETIN GEZ-2969



LEAK DETECTING



LEAK DETECTORS

H-2, -3, -4, -5—These instruments provide a fast, clean, reliable method of locating leaks in pressurized or evacuated enclosures. Each detector includes a highly sensitive element able to locate leaks as small as 1/100 oz. of gas escaping per year.

BULLETIN GEA-6817



LEAK DETECTOR

H-6—A new low cost leak detector for air conditioning and refrigeration servicing. Will locate leaks from $\frac{1}{2}$ oz. of gas escaping per year. Sensitivity is adjustable.

BULLETIN GEA-6827



LEAK STANDARD

LS-20—This new, low-cost leak standard will let you calibrate your leak detector to determine exact size of leak.

BULLETIN GEA-7024



LEAK STANDARD

LS-10—Optional scale ranges of 0.1, 1.0 or 10.0 oz. per year. Combined with leak detector, will give exact leak size from .01 oz. to 10.0 oz. per year. May be used to calibrate H-2, -3, -4, -5, -6 leak detectors.

BULLETIN GEA-7024

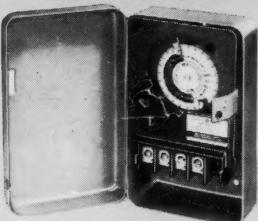
C-G-E Engineers fully experienced in the application of these Instruments are always available to help solve your particular problems. For further information contact your nearest C-G-E office, or Canadian General Electric Company Limited, 940 Lansdowne Avenue, Toronto 4, Ontario.

For further information mark No. 115 on Readers' Service Card

PAGES 9-10 ARE MISSING ADVERTISING PAGES.

for Every Application

TIME SWITCHES



TIME SWITCH

TSA-47—A low-cost, general purpose switch. Available with double-pole single throw, single-pole double throw, single-pole single throw switching. An omitting device may be added quickly and easily to the TSA-47 in the field.

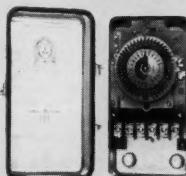
BULLETIN GEA-6681A



HEAVY-DUTY INDOOR-OUTDOOR TIME SWITCH

TSA-40—The TSA-40 will perform any practical number of ON-OFF operations per day, and works efficiently between -50F and 150F. The locking cover is removable for easy installation and maintenance.

BULLETIN GEA-6468



MULTITRIPPER TIME SWITCH

TSA-555—Enclosed in a rugged, weather-proof case, the TSA-555 features dead-front construction, extended temperature range, omitting device, intermittent contacts (optional), and removable locking cover.

BULLETIN GEC-1406



PROCESS TIMER

TSA-14—An easy-to-install, low-maintenance Timer that is ideal for controlling repeating cycles, and circuits where the amount of "ON" time of the double-throw contacts is adjustable.

BULLETIN GEZ-2985

PROCESS TIMER

TSA-18—This versatile Process Timer requires no expensive "extras". With manual or automatic control, it sets to within 1%. Standard time cycles from 60 seconds to 30 hours.



BULLETIN GEC-1223C

PORTABLE



HOOK-ON VOLT-AMMETERS

AK-4 and -5—High-quality, pocket-size instruments for fast, accurate measurement of ac amps and volts. The AK-4 is rated 0-10/30/100/300/800 amps, and the AK-5 0-5/20/80/350 amps. Both have 3 volt ranges: 0-150/300/750 volts. BULLETIN GEA-6292C



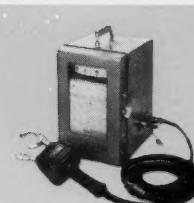
HOOK-ON RECORDING VOLT-AMMETER

CF-7 Inkless—This portable recording instrument gives a permanent record of ac amps and volts. A hook-on, butyl-molded transformer with an insulation rating of 13.2 kilovolts line-to-line is available in addition to the standard 8.7 KV rated transformer.



CF-8—A new hook-on inkless watt-var recorder is also available to give watts and vars on the same chart.

BULLETIN GEA-6821



INKLESS HOOK-ON RECORDING VOLT-AMMETER

CH-7—The CH-7 direct writing recorder has six current ranges, 15/30/75/150/300/750 ac amps, and three voltage ranges, 150/300/750 ac volts... all at the turn of a switch. Provides a complete, accurate record of all electrical-load fluctuations.

BULLETIN GEC-1319

SYSTEM INSTRUMENTATION



MASS FLOWMETER

This self-contained, gyro-integrating mass flowmeter continuously and accurately measures true mass flow of industrial gases and liquids directly in pounds. Its accuracy is unaffected by density variations, pressure variations, and temperature within the rated limits. BULLETIN GEA-6925



DATA LOGGING

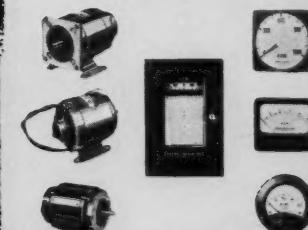
Data logging automates the job of manually entering instrument readings on log sheets.

Automatic data logging scans all quantities according to a pre-established program and provides a typewritten log of all readings.



INDUSTRIAL SPEED MEASUREMENT

A wide range of instruments for indicating and/or recording speed. High accuracy tachometers provide overall system accuracy of 1%.



INDUSTRIAL PRODUCTS DEPARTMENT

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

448-W-460

1961 DESIGN ENGINEERING

and Concurrent ASME Conference

Put those important product drawings and specifications in your briefcase. Make a list of original equipment you want to know more about. Get a big notebook, and pack a pair of comfortable walking shoes. Then head for Detroit's magnificent new Cobo Hall and the biggest, most exciting Design Engineering Show in history.

The best design and development work that over 350 companies can come up with is ready for you to see, compare, and study. The top application engineers of these companies will be on hand to discuss their products with you — go over drawings and specifications — make suggestions — offer you the benefit of their cumulative experience.

SHOW COBO HALL Detroit · May 22-25

Everyone with design-engineering responsibility will benefit from DESIGN WEEK IN DETROIT — and every company will profit by *making sure* its design-responsible executives and engineers have this once-a-year chance to see the latest and best in original equipment. There are three mornings and evenings of concurrent ASME Conference sessions waiting for you, too — all devoted to "*Designing for the Competitive Market*". There is much for you in every one of the Conference's 24 major papers.

For hotel reservations write the Detroit Convention & Visitors Bureau. For other information contact:

CLAPP & POLIAK, Inc. Exposition Management
341 Madison Avenue • New York 17 • MUrray Hill 4-3432

For further information mark No. 120 on Readers' Service Card



How SHAKEPROOF Protects Your Product's Reputation

Here is the answer to one of industry's toughest problems . . . how to reduce costly inspection rejects and avoid customer complaints due to fastening failure.

Shakeproof engineers have gathered formidable evidence that only one washer locks . . . where others fail! Their findings, just published in the booklet offered at the right, prove that "weight and thickness" don't lock a fastener, and that "spring action" alone isn't locking action.

They have conducted tests with various types of washers commonly used for protection against failure caused by handling and operational vibration. Results show that only

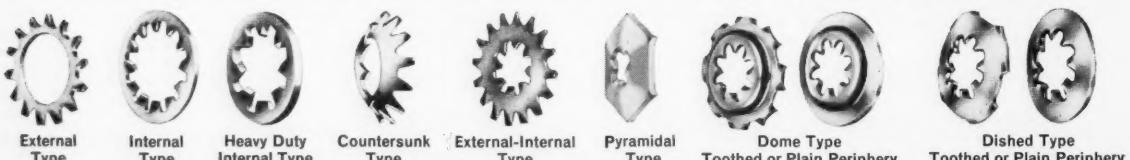
Shakeproof Lock Washers retained 100% relative locking efficiency.

Be sure to protect your product's performance and reputation with the one top-quality, top-performance lock washer . . . Specify SHAKEPROOF . . . the original toothed lock washer!

Send for this Free Booklet Today—it is filled with factual test data and actual case histories which show how you can be sure of quality at every step in the assembly of your product.



STANDARD SHAKEPROOF LOCK WASHERS INCLUDE:



External Type

Internal Type

Heavy Duty Internal Type

Countersunk Type

External-Internal Type

Pyramidal Type

Dome Type
Toothed or Plain Periphery

Toothed or Plain Periphery
Dished Type



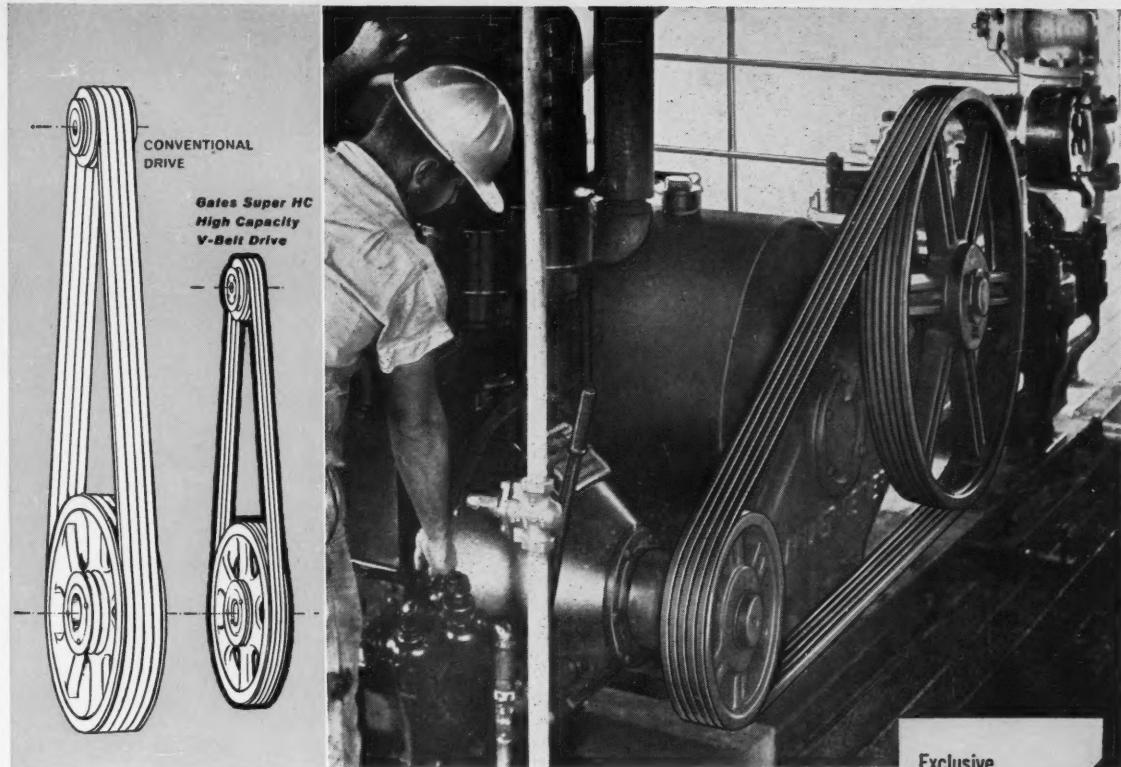
SHAKEPROOF/FASTEX "Fastening Headquarters"®

DIVISION OF CANADA ILLINOIS TOOLS LTD.,

67 SCARSDALE ROAD, DON MILLS
TORONTO, ONTARIO

LOOK TO SHAKEPROOF—THE LEADER IN FASTENING

For further information mark No. 116 on Readers' Service Card



Gates High Capacity V-Belt Drive handles greater power in less space!

Gates Super HC V-Belt Drives, in use throughout Canada on all types of machines, are meeting the industry-wide demand for a means of transmitting greater power in less space.

Because of exclusive design features, Gates Super HC High Capacity V-Belts handle up to 3 times more horsepower than conventional V-belts in the same space. Or the same power can be handled with fewer belts and smaller sheaves, saving up to 50% in drive space and cutting drive costs as much as 20%.

Further, with smaller, lighter sheaves, bearing loads are reduced. Guards, ma-

chine housing, countershafts, etc., can be smaller. Shipping weight is less.

The drive can operate at belt speeds up to 6,000 ft/min without dynamic balancing. This permits use of higher rpm motors, with savings in motor costs.

Industrial plants throughout Canada have standardized upon Gates Super HC V-Belt Drive, the 1st and most advanced high capacity drive. It is your best assurance that your power transmission units will not soon become obsolete.

Your local Gates Representative is an experienced, fully-qualified drive design expert. Contact him for drive design help.

Gates Rubber of Canada Ltd., Brantford, Ontario

X959E

Exclusive
design features
include:



precisely engineered
arched top, con-
cave sidewalls, Flex-
Weave cover, super
strength tensile
construction.

Gates Super HC
Drive saves space,
weight and money

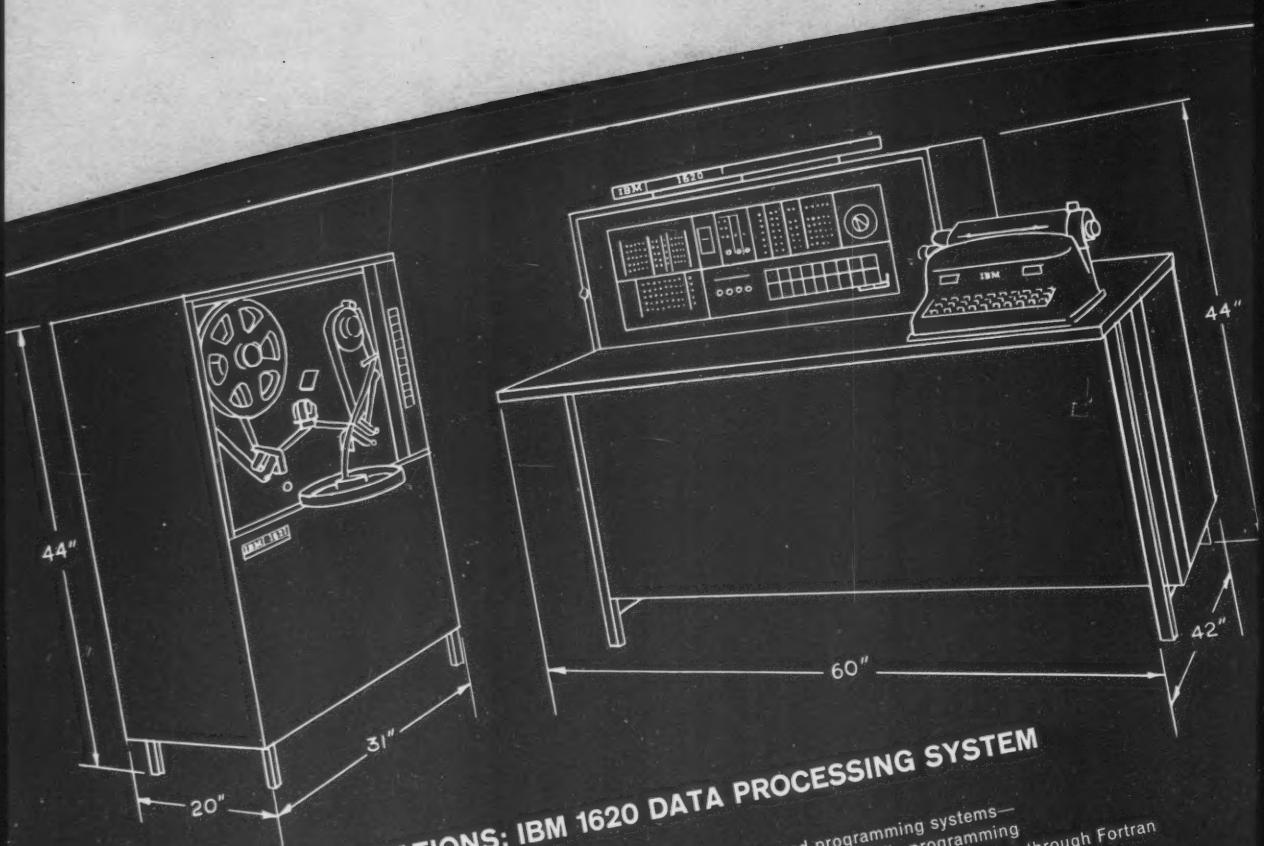


Gates

Building
the future
on 50 years of
progress.

Gates Super HC V-Belt Drives

For further information mark No. 135 on Readers' Service Card



SPECIFICATIONS: IBM 1620 DATA PROCESSING SYSTEM

Core storage—20,000 digits
 Automatic operation—stored programming
 High computing speed—20 microsecond machine cycle
 Powerful instructions with two data addresses
 Decimal and alphabetic
 Variable field and record length—any size numbers

The 1620 will meet technical computing requirements too complex for the conventional desk-type calculator. It provides many advantages of larger systems at a much lower cost. In addition, it can be used to support other data processing systems such as the IBM 650, 704, 705, 709, 7070 and 7090.

Information enters the system from the typewriter of the 1620 Central Processing Unit, or from the 1621 Paper Tape Reader. Output is to the typewriter or 961 Tape Punch.

Advanced programming systems—
 Fortran and symbolic programming
 Compatibility with other computers through Fortran
 Simple console with logging features
 Self checking throughout
 Transistorized circuitry—
 compact, economical, reliable
 Paper tape input and output

Machine	Weight in lbs.	Current Requirements	Power cord	Interconnecting cable	Heat Load Specification BTU/Hr
1620	1,000	20 Amps., 115 Volts, single phase	10' 3-Wire for 115 and 230 Volts	10' signal	5,000
1621	280	10 Amps., 230 Volts, single phase 6.5 Amps., 208 Volts, three phase	10' 4-Wire for 208 Volts	10' power	2,000



**FREE YOUR ENGINEERING STAFF
FOR MORE CREATIVE WORK . . .**

IBM 1620 LOW-COST, DESK-SIZE COMPUTER

**RELIEVES YOUR STAFF OF TIME CONSUMING WORK
. . . SOLVES WIDE RANGE OF SPECIALIZED PROBLEMS**

Problems that used to tie up your engineering staff for days can now be solved . . . with electronic accuracy . . . in minutes! The IBM 1620 is a low-cost, desk-size engineering computer that solves a tremendous range of routine and specialized engineering problems quickly and easily. The 1620 offers you an economical way to increase staff productivity, helps pave the way for profitable growth.

The 1620 is easy to learn, easy to operate, easy to communicate with. It adapts readily to specialized and general problems such as design development, blending problems involving matrix arithmetic, research calculations with differential equations. It facilitates the development of mathematical models for plant and shop operation, and evaluation studies employing statistical techniques such as regression analysis.

IBM also makes available a comprehensive library of mathematical routines and programs as well as reliable customer engineering. These services supporting the 1620 are an important part of IBM Balanced Data Processing. They make it easy for you to make full use of the 1620 in your operations without delay. Like all IBM data processing equipment, the 1620 may be purchased or leased.

BALANCED DATA PROCESSING



IBM

International Business Machines Company Limited
Don Mills (Toronto), Ontario

Please send me further information and complete specifications for
the IBM 1620 Engineering Computer. I am particularly interested in:

(engineering application)

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

CITY _____ PROV. _____



CHARACTERISTICS THAT DETERMINE
RELAY SELECTION NO. 2

Class S—the calipers set at 1 1/4" clearly indicate small dimensions.

where a small, light relay is required

Helpful selection data Class S Series

OPERATING VOLTAGE:

Up to 115 volts d.c. only

CONTACTS:

Normally twin, Code 0-20 ga. Will carry up to 135 watts (max. 2 amps) inductive or non-inductive load. Special contacts as required.

CONTACT CAPACITY:

1 pile-up, maximum 7 springs

COILS:

Up to 7,000 ohms

OPERATING TIME:

Range, 0.002 to 0.030 second

RELEASE TIME:

Range, 0.005 to 0.085 second

RESIDUAL:

Fixed (armature or chromium plated)

The Class S relay by Automatic Electric, is extremely small and weighs less than two ounces, yet it will carry a contact load of 135 watts—or more. Designed to operate in aircraft and on other small-space, high-reliability applications, the Class S has been thoroughly proven under extreme operating conditions, and will pass armed services shock and vibration requirements to 10G. Because of its small mass and slight self-inductance, it can be relied on for fast pulse response.

This is a precision-built, quality relay unaffected by temperature

extremes or by high humidity. Uniquely shaped contact springs provide maximum contact dependability . . . either of the twin contacts can complete the circuit alone . . . and their self-cleaning action assures positive contact and low resistance—every time.

The Class S is one of the finest relays of its type on the market. Call or write Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.

AUTOMATIC ELECTRIC
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

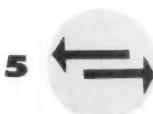
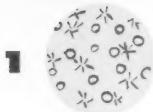


AN ORGANIZATION SERVING CANADIAN INDUSTRIES WITH COMMUNICATION AND CONTROL SYSTEMS
6005R

For further information mark No. 103 on Readers' Service Card

TEST

the unique properties
of this sample



BOILING: Boil this sample in water indefinitely. Notice that there is no change in appearance, elasticity, colour or strength. This ability of Silastic to withstand moist heat and low pressure steam makes it an ideal gasketing material for steam irons, washing machines and dish washers.

FREEZING: Now freeze it in the ice cube tray of your refrigerator, take out the cube and break out the sample. Even after weeks of freezing it is just as rubbery and resilient as ever. Silastic at low temperatures remains pliable and elastic and is an ideal rubber material for aircraft seals, and innumerable extruded and moulded parts destined for cold exposed areas.

BAKING: For a really tough test leave the sample in a 500°F oven for hours. Again the Silastic is unaffected. This characteristic makes it an ideal material for oven door gaskets, hot air ducts, belt coverings and electric frying pan gaskets. You may have a Silastic gasket on your oven.

HEAT CONDUCTING: Place the sample on a burning light bulb and hold it with the end of your finger. In a short time you will feel the heat through the Silastic. This demonstrates its excellent thermal conductivity. This ability of Silastic to conduct heat quickly is very useful in motor insulation, wire coverings and all types of electrical equipment.

Good thermal conductivity means cooler equipment, smaller equipment and more efficient equipment. It is also important in totally encapsulated parts where the Silastic protection does not mean a hotter operating part.

PARTING: Try to stick a piece of pressure-sensitive tape to this sample. Nothing sticks to Silastic (except of course Silastic adhesives). This characteristic is most important wherever there are release problems. Silastic is used for roll coverings and belts handling sticky materials. Silastic gaskets or seals are easily removed.

BURNING: If you hold a match to this sample IT WILL BURN. The interesting thing is the ash — it is silica. When Silastic burns, it does not carbonize, but remains an excellent insulator. This is very important in all electrical applications. Even when the insulation burns the ash continues to insulate. Silastic will never char and conduct.

SILASTIC

Silastic is the Registered Trade Mark of Dow Corning Silicones Ltd.

DOW CORNING

FIRSTIN

SILICONES

DOW CORNING

FIRSTIN

*from one extreme to the other
is the story of Silastic Silicone Rubber*

HERE ARE SOME

applications

There are many other tests that Silastic passes easily but the nature of these tests is such that we could not ask you to try them. One example is solvent resistance. There are Silastic stocks with excellent resistance to gasoline and aromatic solvents that are used in the chemical, petroleum and automotive industries. Another is resistance to ozone and corona, most important in the electrical industry. Another is resistance to weathering: there are innumerable outdoor applications for seals, gaskets, extrusions and wire coverings where only Silastic will last indefinitely. Another is toxicity. Silastic is non-toxic — so non-toxic that artificial heart valves that have to last a lifetime are made from it. There are many other medical, pharmaceutical, and food applications. Silastic is of course unaffected by moisture. Open-frame Silastic insulated motors are regularly cleaned with a hose — while running. Silastic is also resistant to: abrasion, corrosive atmospheres, chemicals and radiation. Take our word for it — there are Silastic stocks that are unaffected by most or all of these tests. Silastic may be moulded, dispersion coated, extruded, coated on wire or calendered. It can be fabricated as readily as organic rubber and can of course be pigmented to almost any desired colour.

Possibly the greatest challenge to industry are the Dow Corning Silastic RTV's. These are liquid rubbers that vulcanize at room temperature — and the vulcanizing time can be as brief as 2 minutes or as long as 24 hours. When it sets up, Silastic RTV has the same basic characteristics as the stocks discussed above. Delicate electronic components can be dipped in it. It can be used to pot whole assemblies. It is the most durable caulking material we have ever seen. You can use it to make your own gaskets. You can also use it

to make moulds or copies of intricate shapes. It will reproduce detail as fine as fingerprints. A new use for Silastic RTV is the encapsulation of random-wound motor coils to provide protection from moisture, water, dirt, vibration, abrasives, chemicals and thermal and mechanical shock. Should a Silastic-protected part or component ever need service the rubber can be cut, the repair made and the Silastic RTV resealed with more self-curing Silastic RTV.

Silastic costs more pound for pound than many other materials. However, the cost of any material is not always what it seems. To find the real price of any item, you have to relate its cost to how well it does the job. In other words you just can't equate price-per-pound to performance. So you're better off to design 'through a problem' with Silastic, than around it with other materials.

You might well say "O.K., Silastic is fine for special purpose applications where premium materials are needed and premium prices can be afforded, but where are the across-the-board applications in ordinary products?" Daily, Silastic in its many forms is moving out of its specialized areas of application to find growing acceptance in industry. Its characteristics mean reliability of a new order, thus long-term economy through reduced or eliminated maintenance and repair of industrial and consumer products.

If you are interested in Silastic silicone rubber we will gladly supply you with complete technical data and samples. Dow Corning does not manufacture parts of Silastic or Silastic coated wire, but we can give you the names of Silastic fabricators or wire manufacturers in your area. We do stock and supply; direct to you, all types of Silastic RTV silicone rubber. For information contact any of our branch offices.



Dow Corning Silicones LIMITED

VANCOUVER

TORONTO

MONTREAL



*what
next!*

*One after another, new Canadian products
are evolving from ONE basic development...
Bach-Simpson's miniature motor-generator*

Simple in concept, complex in execution, the miniature motor-generator is an example of design problems overcome. Precisely engineered and toolied in its entirety in Bach-Simpson Limited's comprehensive Canadian facility, its application becomes steadily more varied.

FREQUENCY METER — First of the family, this accurate pointer-type device derives from the motor-generator's ability to produce output voltage linearly related to input frequency.

CONTROLLER-INDICATOR — In frequency control, the motor-generator's surplus torque is used to produce interrogating pulses for periodic sampling of the indicated quantity. For control of other functions, the motor alone is used.

CONSTANT VOLTAGE SOURCE — The synchronous motor's remarkable

independence of input voltage fluctuations is utilized to produce constant voltage output with constant input frequency.

FREQUENCY-ELAPSED TIME METER — The pointer-type frequency meter's motor-generator provides the driving force for Bach-Simpson Limited's new large read-out elapsed time indicator.

. . . and we've got more ideas!! HOW ABOUT YOU?

Bach-Simpson
LIMITED

1255 BRYDGES STREET, LONDON, ONTARIO

For further information mark No. 107 on Readers' Service Card

Alex Horvath says, “Select-O-Graph is a fast and foolproof aid to selecting tool and die steel”

“The New Select-O-Graph is an absolute must for anyone responsible for the selection of tool steels for specific job applications”—ALEX HORVATH, Vice President, B & K Roller Die Co., Ltd., Toronto.

On January 3rd, 1961, Atlas Steels introduced a new method of selecting tool steel. It is called Select-O-Graph.

Since the beginning of the year, hundreds of executives, engineers and shop foremen have had an opportunity to evaluate Select-O-Graph. A typical response came from Alex Horvath, Vice President of B & K Roller Die Company,



With Select-O-Graph you select steel faster.

Limited. Mr. Horvath, who is in charge of production control, shares a problem with most manufacturers selecting tool steel.

“Some of our men,” said Mr. Horvath, “have a good working knowledge of the tool steels they use. But that only covers 4 or 5

grades. Usually these grades do the job satisfactorily, but quite often specific jobs call for a special



You're sure of getting the most suitable steel for the job.

grade tool steel. When this happened, our engineers used to spend hours going through books and checking figures. Select-O-Graph now gives us exactly what we need in a fraction of the time. It's fast and it's foolproof.

“On a few occasions we also have to convince our customer that our choice of tool steel is correct. Now, instead of preparing a long and involved report, we can show him the complete story in minutes.”

B & K is probably Canada's fastest growing cold-working machinery manufacturer. Last year the com-

pany tripled its size. They employ 85 people and produce roll-forming equipment and cold working steel machinery in general for the U.S. as well as Canada.

Alex Horvath concluded the interview by saying, “Select-O-Graph has a permanent place at B & K. And our engineers and foremen have only one complaint, Select-O-Graph should have come out twenty years ago.”

Select-O-Graph charts are available at your nearest Atlas branch office, or by writing directly to: SELECT-O-GRAPH, ATLAS STEELS LIMITED, WELLAND, ONTARIO.



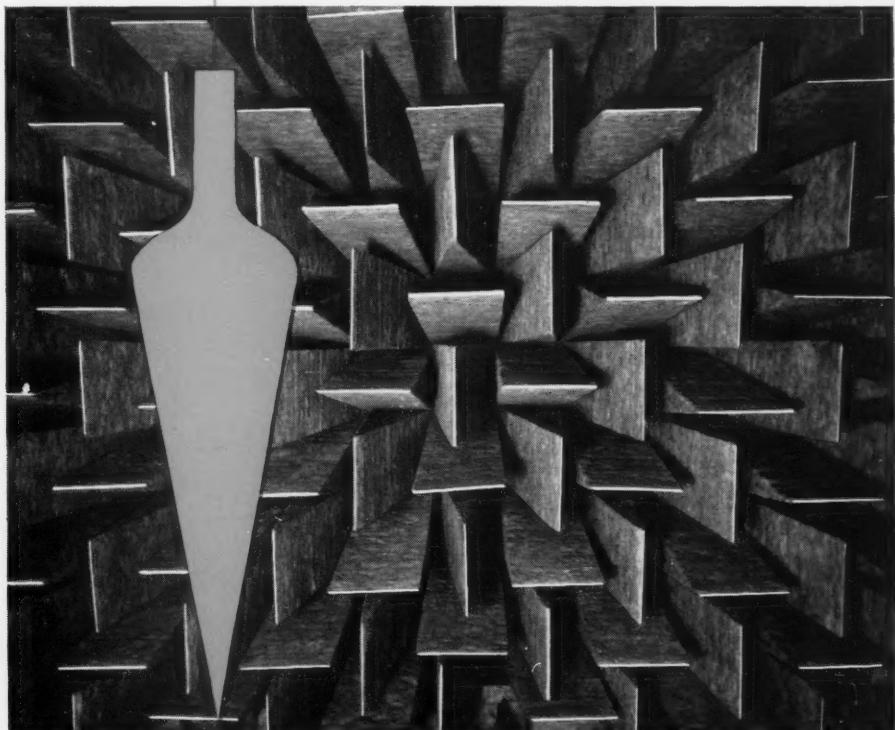
Select-O-Graph should be on your office wall.

For further information mark No. 102 on Readers' Service Card

TO PLUMB NEW DEPTHS

IN SOUND, Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

■ RESEARCH AND DEVELOPMENT LABORATORIES

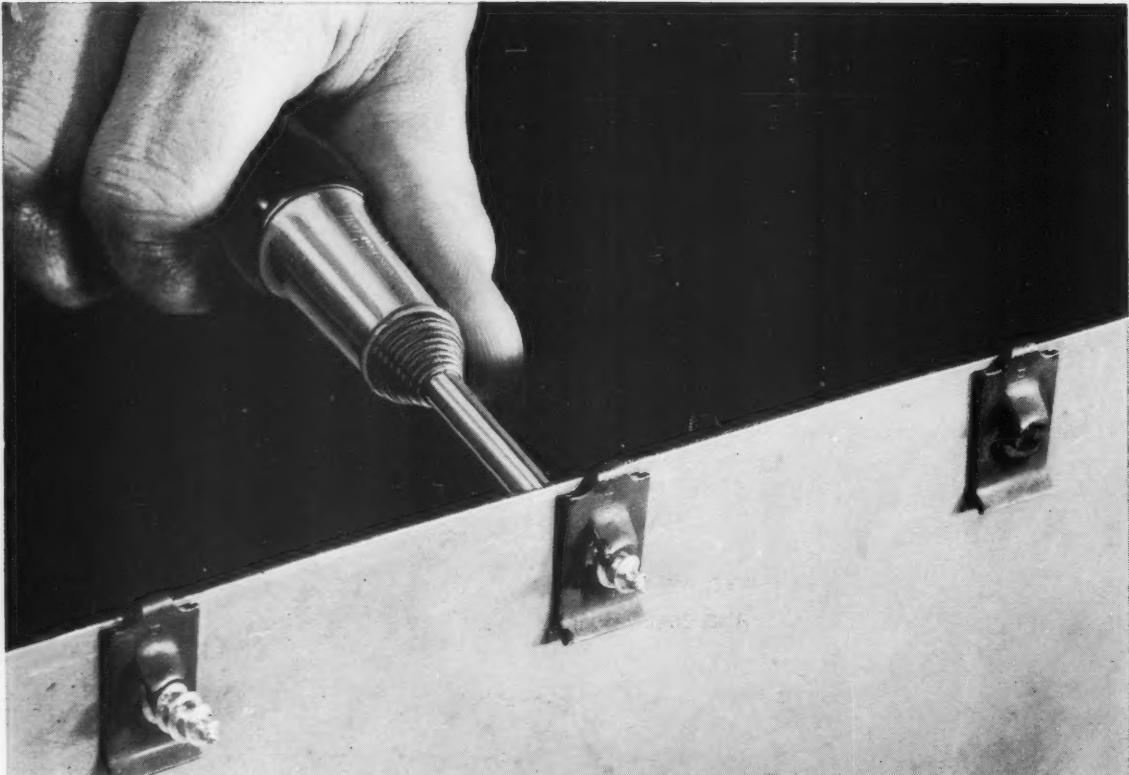


Northern Electric
COMPANY LIMITED

SERVES YOU BEST

6660-26 .

Now, more than ever, it's time to cut costs



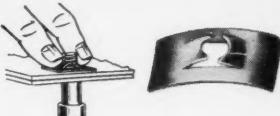
**Speed Nut Fasteners give savings from
30% to 75% or more over other methods**

Competition for your share of the market is increasing from home and abroad. By reducing your product assembly time and lowering fastener costs you will improve your profit picture and make your product more competitive.

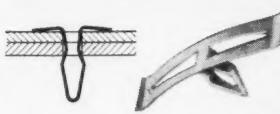
Dominion Fasteners Speed Nuts *will* reduce assembly time; *will* lower fastener costs; *will* improve your profit picture. Investigate the Speed Nut method of fastening.

Speed Nuts can save time and money in your assembly. There are over 8,000 types and sizes available

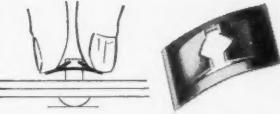
FLAT TYPES—one piece, self-locking. Replace threaded nuts, lock washers and spanner washers.



DART-TYPE CLIPS—dart portion compresses as it is snapped into hole, springs back to retain itself in place, or to lock panels together.



PUSH-ONS—zip over unthreaded die-cast or plastic studs, rivets, nails, tubing or wire to lock parts securely.



TUBULAR CLIPS—for use with unthreaded studs or rivets on attachments where there is access to front side only.



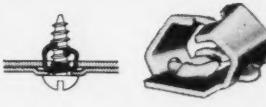
"J" TYPES—snap over edge of panels or into centre-hole locations. Hold themselves in place for blind assembly.



"U" TYPES—perform same function as "J" types, used where full bearing on lower leg of the Speed Nut is required.



EXPANSION TYPES—for fast assembly in blind locations where there is access to one side only. Snap by hand into square holes.



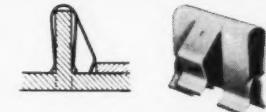
SPEED GRIPS—snap easily into bolt-receiving position without use of special equipment or skills; provide floating alignment.



CABLE CLIPS—snap in place by hand and hold themselves in position by "heel and toe." Easily removed for servicing.



"U" AND "S" CLIPS—for attaching metal, plastic or wood panels with a spring cushion. Eliminate holes in panels.



COMPRESSION RINGS AND "C" CLIPS—for attaching plastic knob-to-shaft assemblies. Faster permanent assembly is assured.



TUNING FASTENERS—for better, faster mounting of radio coil forms. Hold core in position and provide tension on adjustment screw.



Dominion Fasteners FASTENING ANALYSIS SERVICE

Make us prove to you that Speed Nuts will cut your production costs. Our skilled engineers will take one of your finished units, disassemble it, study it piece by piece, and reassemble it using Speed Nuts where applicable. Then, in a detailed report, we will give you an accounting of the time and cost savings

affected by the use of Speed Nuts. If there is not a fastener already produced that is suitable for your particular application, we will design one that is.

This fastening analysis service is free—take advantage of it today.

Write for full particulars:
DOMINION FASTENERS LIMITED
a Geo. A. Tinnerman corporation
Hamilton, Ontario
Sales Branches: Toronto, Montreal

DOMINION FASTENERS

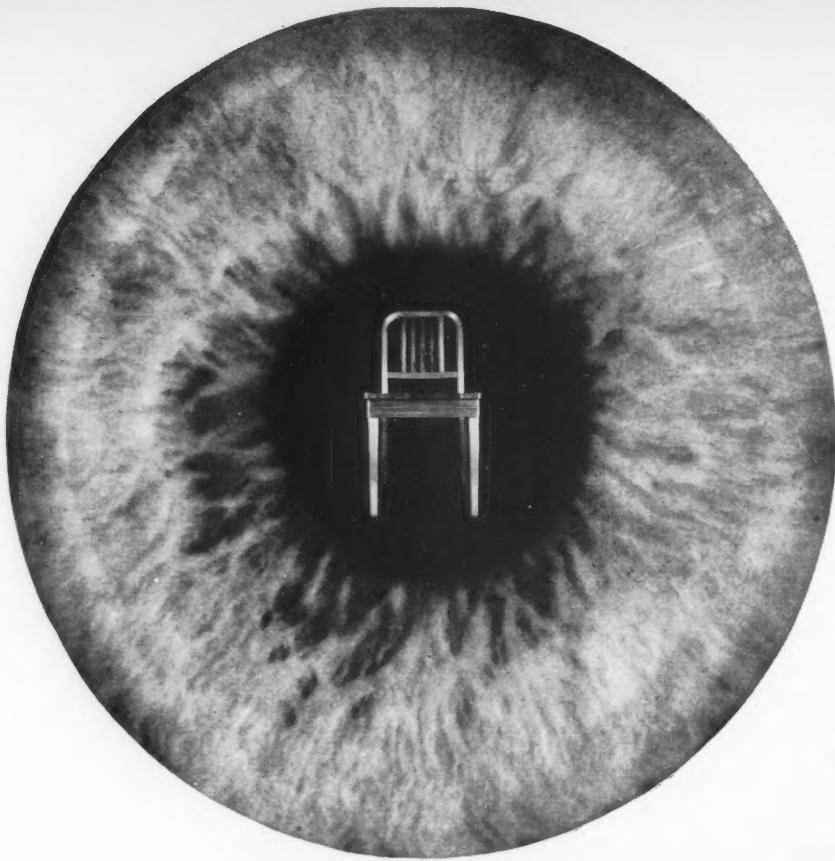
Exclusive TINNERMAN Canadian Licensee

33-608

Speed Nuts

For further information mark No. 125 on Readers' Service Card

DESIGN ENGINEERING APRIL 1961

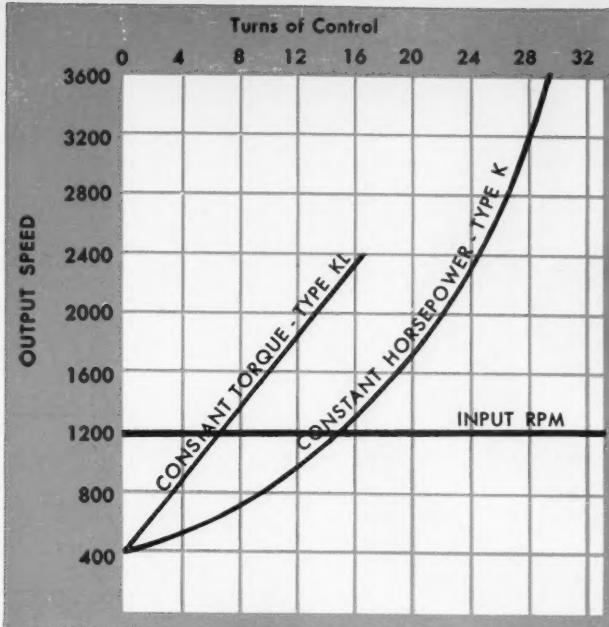


Keep your seat while you keep your eye on 20 operations—and more...with Veeder-Root's High-Speed Magnetic Counter. At a glance, a quick review of plant production from one central location...complete visual control without legwork or guesswork. It's easy with Veeder-Root remote readout counters on the job. Compact in design, easy to install, these versatile counters are finding their way into more and more new machinery designs...are being added to existing equipment to streamline and centralize plant control. For more information write: Electrical Section, Veeder-Root of Canada, Ltd., P.O. Box 156, Toronto 18. **count on...Veeder-Root.**



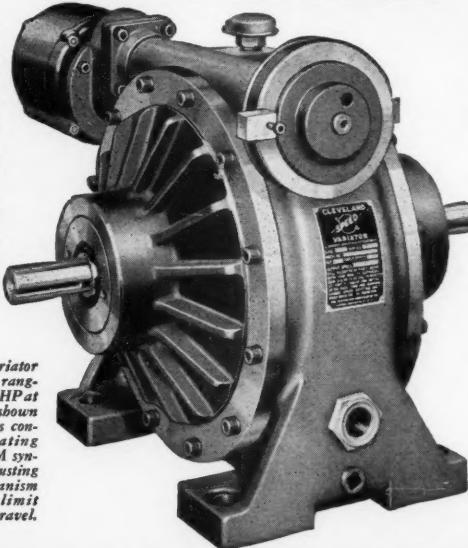
This electrically actuated Veeder-Root counter, Series 1591, reports machine output directly from factory to your office...operates on regular lighting circuit, drycells, storage battery or other power supplies.

For further information mark No. 173 on Readers' Service Card



Typical speed regulation curves for the Types K and KL Variators. Type KL offers a linear speed regulating pattern, often an advantage in automatic control applications. Output speed regulation of the Type K Variator follows a geometric progression pattern. Starting at the minimum output speed, each turn of the speed regulating wheel produces a fixed percentage increase in output shaft speed.

The Cleveland Speed Variator is available in 18 models ranging from fractional to 16 HP at 1750 input RPM. Unit shown at right, used in process control, has speed regulating worm driven by 75 RPM synchronous motor, with adjusting shaft indicating mechanism modified to actuate limit switches to prevent overtravel.



CLEVELAND SPEED VARIATOR

Accurately Provides Dependable, Infinitely Variable Speed Control

ANNOUNCED late in 1954, the new Cleveland Speed Variator met instant, enthusiastic acceptance. Engineers and designers of industrial equipment already have put thousands of units into use on such varied equipment as cigarette making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

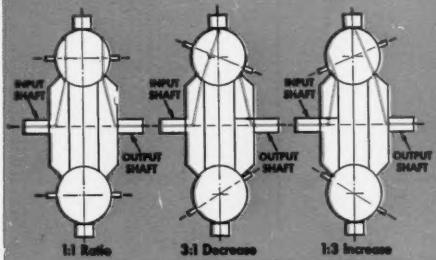
Infinitely variable, the Cleveland Speed Variator gives stepless speed over a full 9:1 range—from $\frac{1}{3}$ to 3 times input speed. Output speed can be adjusted by either a hand wheel on the Variator or by manual or automatic remote control.

The Cleveland Speed Variator offers these major advantages:

1. An extremely compact unit with input and output shafts in line and rotating in the same direction.
2. Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.
3. Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.
4. Speeds infinitely variable over entire range of adjustment.
5. No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.
6. Long life and minimum maintenance due to absence of belts or complicated linkages.
7. Ample bearing support for overhung pulleys on both input and output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

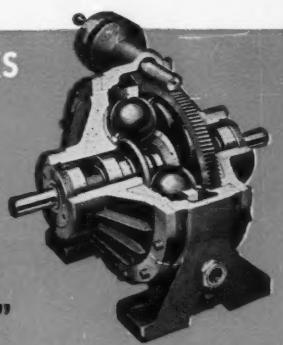
HOW THE CLEVELAND SPEED VARIATOR WORKS



Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (diagram, right, shows cutaway Variator with hand regulating wheel).

"It's the Drive That's on the Ball."



PEACOCK BROTHERS LIMITED

P. O. Box 1040 • Montreal

SYDNEY • TORONTO • SUDBURY • WINNIPEG • EDMONTON • CALGARY • VANCOUVER

For further information mark No. 153 on Readers' Service Card



HEAT

RAVAGES METAL SURFACES

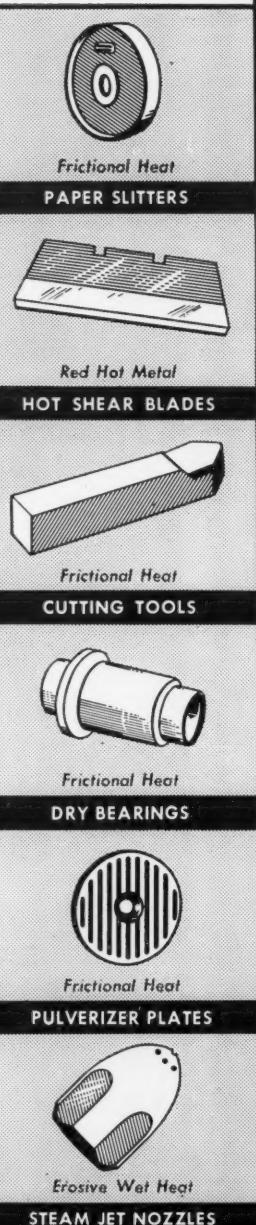
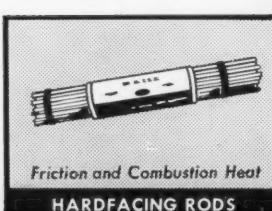
Downtime . . . zero . . . this is an ideal now within reach through Deloro Stellite cobalt or nickel base alloys. Where heat . . . from destructive jet engine inferno temperatures to light, frictional wear . . . is responsible for downtime, vital parts produced by Deloro Stellite, at prices comparable to special steels, offer incredible performance.

Achieve a new dimension for "NORMAL DOWNTIME" with Deloro Stellite castings and hardfacing.

Write for your free copy of "375 Ways to Speed Production, Cut Maintenance."



DIVISION OF DELORO SMELTING & REFINING COMPANY, LIMITED



For further information mark No. 124 on Readers' Service Card



Human element still has pride of place in Bristol instrument engineering

Bert Blackmore, manager of the engineering department of The Bristol Company of Canada, and Larry Maxner, panel design engineer, put their heads together on the design of a new instrument panel for a major Canadian mining company.

Bert Blackmore is typical of Bristol personnel: a graduate engineer, he has spent his entire professional career, apart from his years of war service, with The Bristol Company of Canada. He brings experience gained as a field representative in Montreal and Western Ontario to his present position as head of the

key engineering department.

Bristol's engineering department is living proof—if proof be needed—that the human element has not diminished in importance due to the growth of automation. Where instruments provide the key to automating a process, the human know-how that goes into the initial creative planning assumes critical importance.

It takes skilled engineers, such as the men of Bristol, to get the most from today's wide range of instruments and controls. With the vast number of attachments available for Bristol instruments,

instrument panel designers can meet almost any requirement for measuring, recording or controlling through combining and modifying standard items. This results in added economy and efficiency for the user.

Instruments are only as good as the men who design, build and engineer their use—that's why Bristol Instruments are best! For more information, write or call today. The Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto 2.



Bristol Instruments

MEASURING CANADIAN INDUSTRIAL PROGRESS FOR THREE GENERATIONS

For further information mark No. 110 on Readers' Service Card



CONTROL CONVENIENCE



*Model 55-REM
Gas Control*

Fully Adjustable • Completely Self-contained

... an assembly and service time saver!

Adjustable pressure regulator, A and B cocks, automatic safety pilot and pilot filter are all built-in to this compact, efficient unit. Its design was pioneered by *A. P. Controls*—and it's made in Canada by Controls Company Canada Limited.

Controls Company Canada Limited manufactures a broad range of precision controls and motors for Canadian industry. Each is a product of *integrated engineering* for complete compatibility, one with another, in systems installations; each is *versatile* and *adaptable*, for top performance in existing equipment or designs.

For product literature, catalogues or assistance with specific control problems, call or write Controls Company Canada Limited, Cooksville, Ontario.



CONTROLS COMPANY



Creative controls for industry

CANADA LIMITED

COOKSVILLE, ONTARIO

OIL, GAS AND REFRIGERATION CONTROLS • SOLENOIDS • TIMERS • SWITCHES • MOTORS

For further information mark No. 121 on Readers' Service Card



RUBBER in Design Engineering



PROPERTIES	Non-Oil Resistant			Oil Resistant	
	Natural	SBR	Butyl	Nitrile	Neoprene
Tear Resistance	Excellent	Poor-fair	Good	Fair	Good
Abrasion Resistance	Excellent	Good	Good	Excellent	Excellent
Compression Set Resistance	Good	Good	Good	Very good	Good
Permeability to Gases	Fair	Fair	Excellent	Very good	Very good
Aging (Sunlight)	Poor	Poor	Excellent	Fair	Excellent
Aging (Oxidation)	Good	Good	Good	Fair	Good
Aging (Heat, max. temp. F.)	200	250	300	250	250
Solvent Resistance (Aliphatic Hydrocarbons)	Very poor	Very poor	Poor	Good-Exc.	Fair
(Aromatic Hydrocarbons)	Very poor	Very poor	Poor	Fair-good	Poor
Oil Resistance (Low Aniline)	Very poor	Very poor	Very poor	Fair-Exc.	Fair
Oil Resistance (High Aniline)	Very poor	Very poor	Very poor	Fair-Exc.	Good
Gasoline Resistance (Aromatic)	Very poor	Very poor	Very poor	Fair-good	Fair
Gasoline Resistance (Non-aromatic)	Very poor	Very poor	Very poor	Good-Exc.	Good
Cold Resistance (Min. svc temp. F.)	-65	-70	-65	-65	-50

This table gives you an idea of how some rubbers react to various conditions. In designing, consult your Garlock rubber specialist to achieve best application results.



Garlock offers dozens of different types of rubber, each carefully chosen and processed to meet your exacting needs . . . natural rubber with high tensile strength where real "rubber-like" properties are required . . . styrene butadiene rubber, the work horse of the industry—a low cost material for use where a good, rugged general purpose compound is required . . . neoprene rubber where good oil and abrasion resistance and aging characteristics are important. In addition, Garlock offers a wide range of nitrile and butyl compounds where their special properties are required. For more difficult applications Garlock offers a complete line of specialty rubbers from silicone for high and low temperature service to VITON* for extreme temperature and solvent resistance.

Thoroughly tested to meet ASTM standards. Over twenty various tests are conducted on rubber materials before, during, and after manufacture to assure top performance. First, the rubber is carefully compounded and mixed exactly to specification. Then it is measured for durometer hardness, tensile strength, elongation . . . resistance to water, weather, temperature . . . many other vital characteristics. Scientific measurements like this, using ASTM, SAE-ASTM, and military standards—plus quality control during man-

ufacture—assure you of the finest rubber parts available.

No two rubbers are alike. Each has its own individual strong points; each performs better under one set of conditions than another. In the design stage, call in your Garlock representative. He's a specialist in rubber parts and will assist you in selecting the proper material. Then, too, he may have several cost-saving ideas to suggest. You

GARLOCK

can reach him at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-167, Garlock of Canada Ltd.

General Offices: Toronto, Ont.

Branch Offices: Hamilton, Montreal, Winnipeg, Edmonton, Vancouver

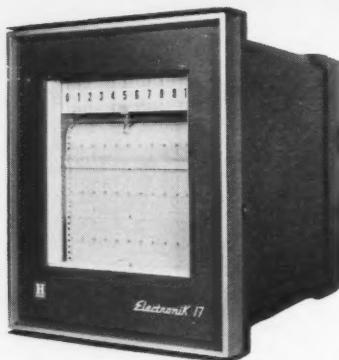
Plastics Div.: United States Gasket Company

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*Registered Trademark

For further information mark No. 134 on Readers' Service Card

CAN ONE OF THESE NEW HONEYWELL DEVELOPMENTS HELP SOLVE ONE OF YOUR PROBLEMS?



in process control

Electronik 17 STRIP CHART RECORDER

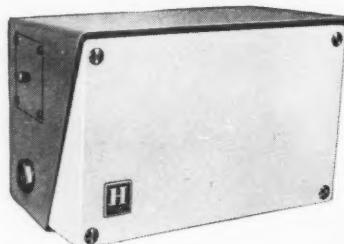
Revolutionary potentiometer design in new Honeywell Electronik 17 Instruments. They fit standard 19-inch racks, have—0.25% calibrated accuracy, with either strip or circular chart recorders or circular scale indicators. New Stranderer rebalancing unit replaces conventional slidewire. Modular construction and plug-in components make Electronik 17 easiest of all potentiometers to operate, convert and maintain.

R/S #138

ElectriK Tel-O-Set TRANSMITTER

Honeywell ElectriK Tel-O-Set, the first true two-wire control system and simplest system available for process control. Two unshielded wires carry both signal and power from transistorized transmitters to any one of a wide variety of receiving instruments and controllers. Quick-connect and plug-in design reduces parts inventory and maintenance.

R/S #137



in research and test instrumentation

MODEL 1108 VISICORDER

New model Honeywell Visicorder direct-writing recording oscilloscope for high-speed measurement and recording of dynamic data. Simultaneous recording of up to 24 channels of data at frequencies of up to 8,000 cps, producing instantly readable and useable records. Other models—906, 1012, and 1406,—cover range up to 36 channels.

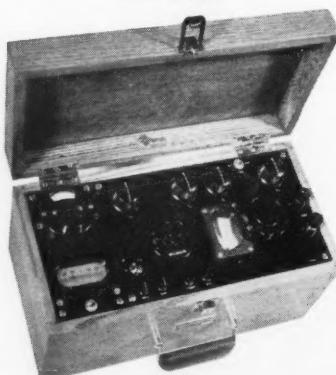
R/S #139



MODEL 2745 RUBICON POTENTIOMETER

Truly compact precision potentiometer. Barely half a cubic foot in size and weighing only 21 pounds, Rubicon Model 2745 portable precision thermocouple potentiometer covers the entire range of thermocouple measurements—both noble and base-metal measurements. It employs a unique method of manual compensation for thermocouple reference junction emf. Other laboratory type instruments available.

R/S #140



Honeywell offers the fullest line of control, research and test instrumentation. One source can fill every need. For complete information, call your nearest Honeywell office or write Honeywell Controls Limited, Industrial Products Group, Toronto 17, Ontario.

Honeywell



Industrial Products Group



FIRST for supersonic jets . . .

NOW for industry . . .

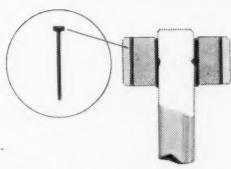
"SCOTCH-WELD"

BRAND

STRUCTURAL ADHESIVES

This amazing new "chemical welding" process enables you to fabricate without welds or rivets, solve design problems, and reduce parts assembly costs

Adhesive bonding of thin metal aircraft skins, metal braces, stiffeners and other parts was pioneered by the aircraft industry to develop stronger yet lighter, faster, higher flying planes. Certainly, if "Scotch-weld" Structural Adhesives are used to advantage in assembling multi-million dollar high-speed aircraft, they can also be used to advantage in load-bearing applications in many other industries. This modern, high strength method of joining metals, reinforced plastics and other materials, permits improved design and production techniques, cuts costs and offers many unique benefits . . . smoother contours . . . lighter gauge materials . . . reduced inspection . . . unusual combinations of materials, and so forth. Already, "Scotch-weld" Structural Adhesives have solved design and production problems for manufacturers of appliances, metal shipping containers, pneumatic tools, pumps, motors, scaffolding and many other items. They may be able to do the same for you. Mail the coupon and let us show you how.



Adhesive bonding small pinion gears to rotor shafts provided savings of \$56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



**MINNESOTA MINING AND MANUFACTURING
OF CANADA LIMITED
LONDON, CANADA**

. . . where research is the key to tomorrow

For further information mark No. 147 on Readers' Service Card

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED
Box, 757, London, Ontario

Please send me complete information about the new "Scotch-weld" Brand Structural Adhesives.

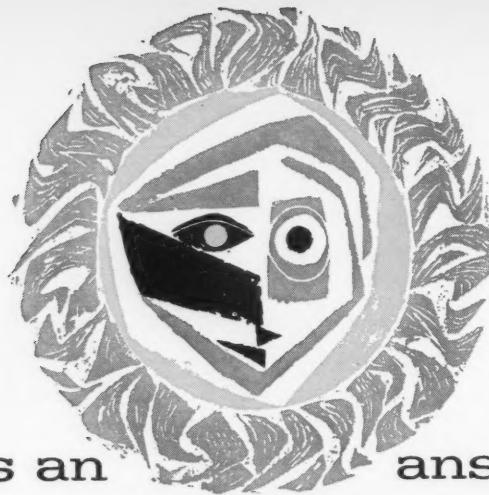
NAME.....

COMPANY.....

ADDRESS.....

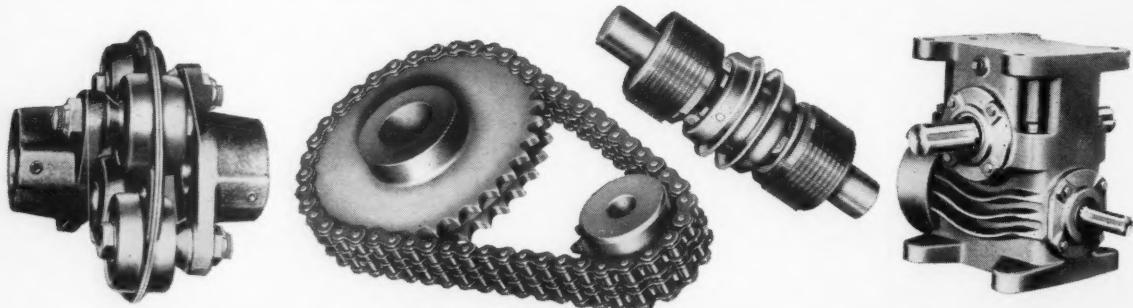
CITY..... PROV.....

104305



Morse has an answer to every industrial drive problem under the sun

Basic Drives, Speed Reducers, Couplings, Clutches—only Morse makes all four and only Morse stocks all four. For example, if your industrial drive problem involves basic drives such as roller chain, silent chain, and Hy-Vo® Drives, or "Timing"® belts, friction clutches, and couplings, too, look to Morse for the answer. You'll get impartial engineering help and immediate delivery.



As for quality, Morse products speak for themselves: Morse timing chain is specified as original equipment by every Canadian automobile manufacturer. Therefore, no matter what your industrial drive problem, your Morse distributor is the man to talk to. He's listed in the classified directory under Power Transmission. Or write: Morse Chain of Canada, Ltd., A Borg-Warner Industry.

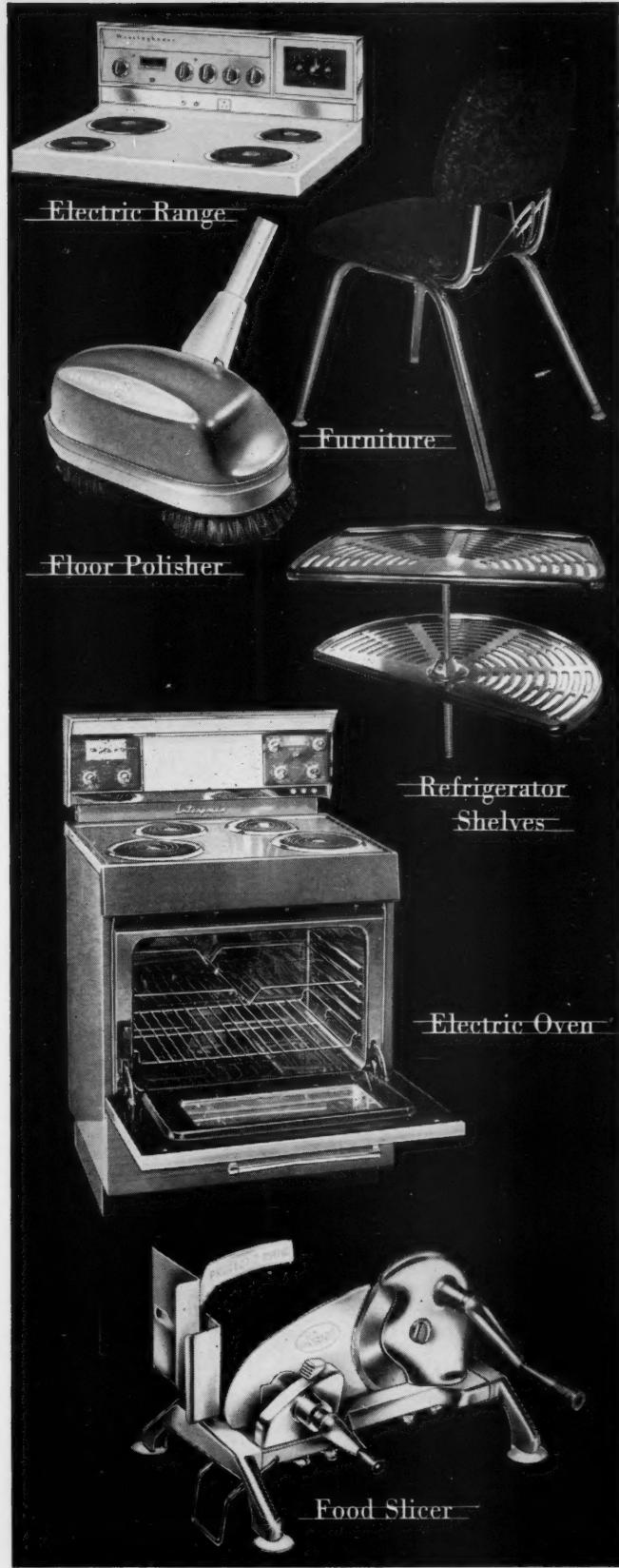


Factory: Simcoe, Ontario; GA 6-4960
Sales Offices: Toronto LE 6-7177; Montreal HU 8-1300

MORSE
A BORG-WARNER INDUSTRY



For further information mark No. 148 on Readers' Service Card



DESIGN for SALES APPEAL

with
a lustrous,
lasting finish of
Nickel-Chrome Plating
on any basis metal

This means you can now combine the beauty and protection of Nickel-Chrome Plating with the many special properties—performance, fabricability and practical cost—of a wide variety of other metals. Whatever basis material you choose for your product, Nickel-Chrome Plating will give it lustrous, matching beauty with brilliant blue-white colour . . . beauty with outstanding durability. Nickel-Chrome Plating to specification protects basis metals from rust and corrosion, nicks and scratches. Creates lustrous, lasting beauty . . . with the eye appeal that makes for sales appeal. Write for a free copy of "Quality Plating."

THE
**INTERNATIONAL
NICKEL**
COMPANY OF CANADA, LIMITED 
55 YONGE STREET, TORONTO

For further information mark No. 144 on Readers' Service Card

NOW in aerospace MORE THAN EVER

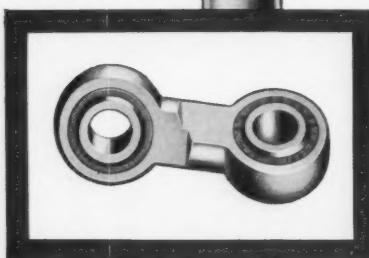


Where There is a Mechanical Linkage.....There are

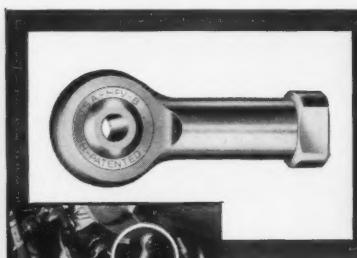
HEIM *Unibal*[®] SPHERICAL BEARING ROD ENDS

AUTOMATIC STABILIZATION AND CONTROL OF SPACECRAFT
GROUND POWER PACKAGE FOR JET AIRCRAFT
INBOARD CONTROLS, AND IN EVERY TYPE OF AIRCRAFT
ENGINE FROM PROP TO TURBOJET
DAMPENER LINKAGE IN MISSILES

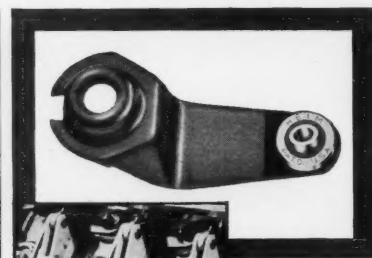
Unibal is the original spherical bearing with the single ball set in bronze bearing inserts, designed, engineered and built by The Heim Company. They are available from your local bearing distributor in a wide range of sizes and materials, including sintered metal components, and teflon linings for self-lubrication.



The single ball construction of the Unibal Spherical Bearing permits its comparatively simple adaptation to special applications such as this double offset link.



Heim Unibal Rod Ends as used in the linkage for the dampener installation on the Atlas fuel manifold.



Heim Unibal Spherical Bearing assembled with the variable pitch stator vanes in the jet engine, act as the pivot points.



For sales or engineering aid, or for catalog or latest bulletins, see your bearing engineering specialist, or write:

R&M BEARINGS CANADA LTD.

QUEBEC CITY	MONTREAL	WINNIPEG	THREE RIVERS
755 Blvd. des Capucins	1006 Mountain St.	1302 Notre Dame Ave.	375 St. Georges St.
TORONTO	VANCOUVER	LONDON, ONT.	HAMILTON
33 & 50 Edward St.	1066 Seymour St.	1024 Oxford St. East	130 Ferguson Ave. N.
			385 Joliette St.

FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

For further information mark No. 136 on Readers' Service Card



THE FINISH THAT GIVES YOU A HEAD START

This bright and shining coil of Noranda brass strip is just off the production line — ready for use by a manufacturer in fabricating a component or a finished product.

If you are the user, you will find that it will give you a head start — by contributing to the efficiency of your fabricating operations and by improving the quality and performance of your product. For all production at Noranda is completely

integrated to assure the finest in copper and copper base alloys in rod, wire, strip and tube. This integrated control, starting with the mine and carried through every manufacturing stage, is unique in Canada and is responsible for the increasing demand—in both Canadian and export markets—for Noranda brass mill products. We invite your inquiries for information and technical assistance.

THE KEY TO THE BEST IN METALS

Noranda Copper and Brass Limited
SALES OFFICES: Montreal • Toronto • London • Edmonton • Vancouver



CHEMICAL RESISTANCE — Hose with tube of "Hypalon" carries sulphuric acid and shows no internal damage in over two years of service. "Hypalon" resists strong oxidizing chemicals.



COLORABILITY — Auto door strips with coating of "Hypalon" in wide range of light, stable, matching colors are protected against ozone, sunlight and weather.



OZONE RESISTANCE — "Hypalon's" resistance to ozone is amazing! Compounds have been unaffected by the highest ozone concentrations producible in commercial generators.



ABRASION RESISTANCE — Calender roll with cover made of "Hypalon" resists heat and abrasion. Service life of roll is lengthened ten times over previously used rubber compounds.

New Synthetic Rubber — "Hypalon" Helps Make Colorful Products that Perform Better.

"Hypalon" is a relatively new Du Pont synthetic rubber. Its outstanding properties actually put it in a class by itself. "Hypalon" has extraordinary resistance to oxidation by sunlight and weather. It is completely ozone-proof. It resists heat and oxidizing chemicals.

One of the most unique characteristics of "Hypalon" is that it can be compounded into white or an unlimited range of colored compounds stable to sunlight exposure. Solution coatings in color are also available. These suggest a wide variety of product applications.

In addition to the properties illustrated at the left, other important qualities of "Hypalon" are:

WEATHER RESISTANCE — Bright-colored products made with "Hypalon" retain their color in all kinds of weather.

ELECTRICAL CHARACTERISTICS — Good dielectric strength; dielectric constant and power factor for service up to 600 volts.

HARDNESS — Products made with "Hypalon" range from 55 to 95 (Shore Durometer A)

HEAT RESISTANCE — Better than that of other general purpose rubbers at 121° C. — 149° C. continuously and up to 177° C. intermittently.

FLAME RESISTANCE — "Hypalon" will not propagate flame and is self-extinguishing when flame is removed.

LOW TEMPERATURE — Most compositions retain flexibility in range of -34° C. to -40° C. and have been formulated to resist -44° C.

FLEXIBILITY — Excellent with outstanding resistance to cracking.

You can get your regular copy of "Elastomers Notebook", and more information about "Hypalon" by writing to:

Du Pont of Canada Ltd., 85 Eglinton Ave. East, Toronto, Ontario.



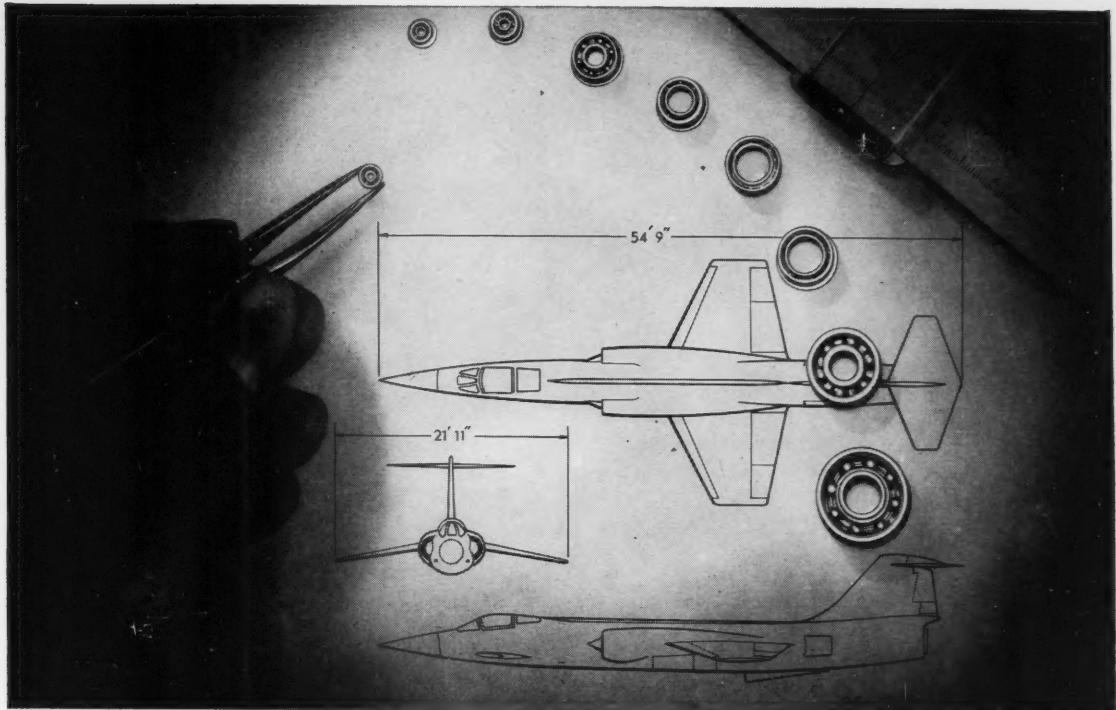
Better Things for Better Living . . . through Chemistry



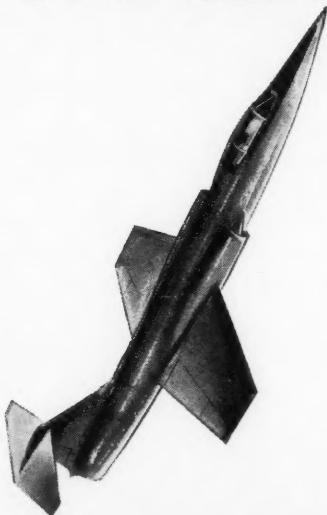
DU PONT ELASTOMERS

NEOPRENE
HYPALON®
VITON®
ADIPORENE®

*Registered trademark of E. I. du Pont de Nemours and Co. (Inc.)



**Sole Canadian Manufacturers of
ULTRA-HIGH PRECISION INSTRUMENT BEARINGS**



Manufactured to tolerances as fine as ABEC 7 (or finer), these minute gems of modern bearing technology are designed to fulfil the most severe requirements of "space age" instruments which control the vital air vehicles of the free world's defence and research programs.

Produced from both 52100 and Stainless Steels, FISCHER Instrument Bearings are available in either inch or metric dimensions. Additional feature requirements, such as shields, seals or flanges, are also readily obtainable.

The quality of FISCHER ball bearings is derived from the Company's accumulated skill in this craft, since FISCHER first founded the Ball Bearing industry in 1883.

Your nearest FISCHER Engineering Office will be pleased to discuss your bearing requirements with you.

Engineering and Sales Offices

FISCHER

BEARINGS MANUFACTURING CO.
LOS ANGELES—ORCHARD LAKE, MICHIGAN

FISCHER

BEARINGS (CANADA) LIMITED
MONTREAL, STRATFORD, TORONTO

Distributors across Canada



Since 1883

Ultra High Precision Instrument Bearings • Aircraft Bearings • Industrial Bearings
Water Pump Shaft Assemblies • Steel Balls.

For further information mark No. 131 on Readers' Service Card

FBM-9519.

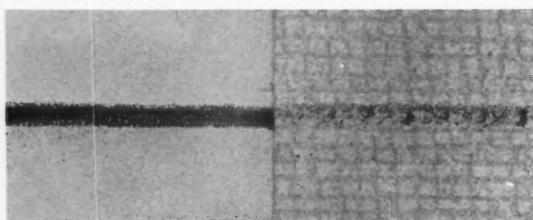
Simple Pencil Test Affords Dramatic Proof:



CRONAFLEX* HAS THE BEST DRAFTING SURFACE YOU CAN USE!

Here's an easy way to prove to yourself the superior draftability of CRONAFLEX: place a sheet of it on your drawing board, side by side with whatever drafting material you've been using. Now draft several lines on each. Erase and re-draft. Use your own tools, your own techniques.

Examine the lines you've drawn with a magnifying



Compare pencil acceptance of CRONAFLEX (left) with that of ordinary drafting material. Same pencil made both impressions! CRONAFLEX gives a faster, cleaner, lighter touch, too, because you don't have to bear down as you must with cloth.

glass. Notice the difference in covering power, cleanliness of erasures and line density — especially where lines have been re-drawn. You've just demonstrated three important reasons why CRONAFLEX is the best drafting film available: excellent *pencil acceptance*, outstanding *erasability* and good *re-drafting characteristics*.

CRONAFLEX has other advantages, as well. Its rugged "Cronar"** polyester base holds its size and resists kinking. It's .004" thick for easier, more efficient handling. Because CRONAFLEX is manufactured from start to finish by Du Pont, you're assured of consistent performance found in no other drafting film. To learn more, write: Du Pont of Canada Limited, Photo Products, 85 Eglinton Avenue East, Toronto 12, Ontario.

*Registered trademark of E. I. du Pont de Nemours and Co. (Inc.)



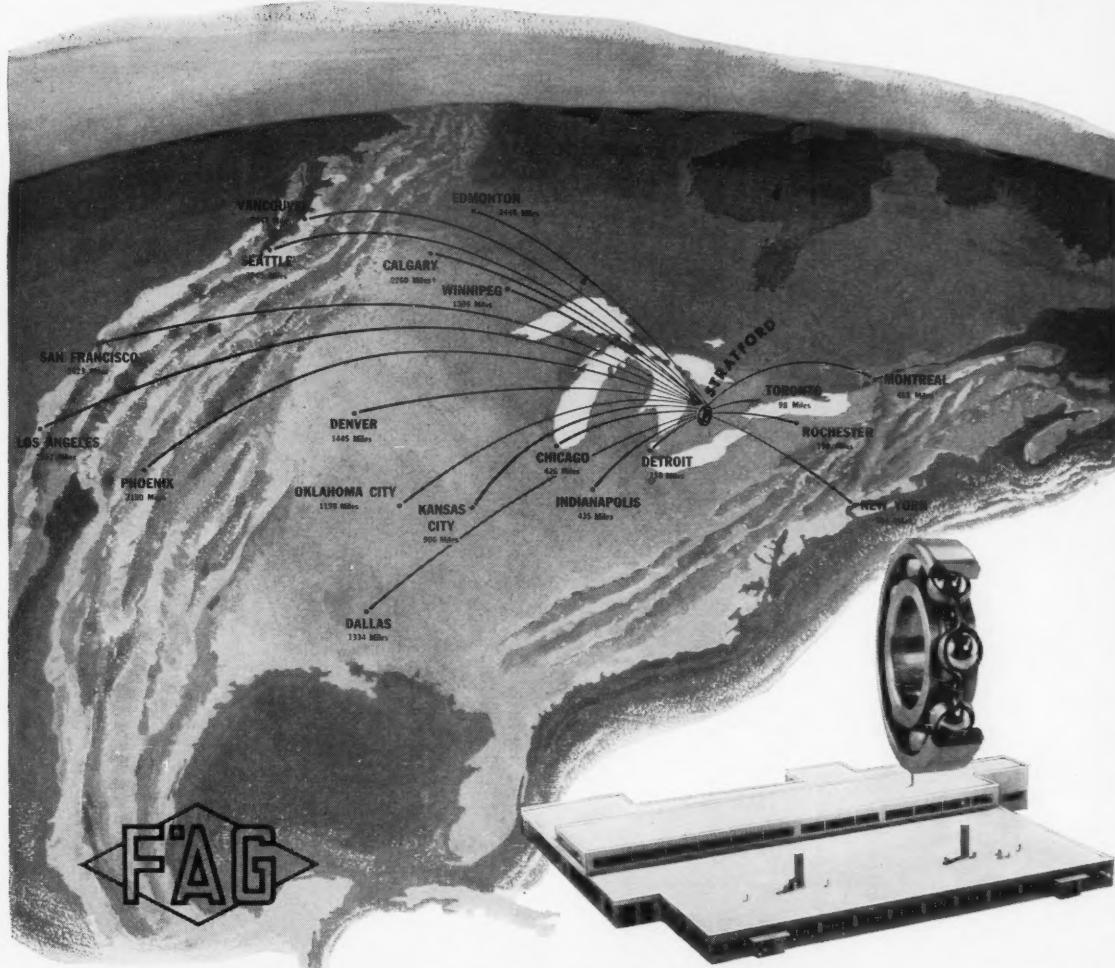
BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

For further information mark No. 130 on Readers' Service Card

FISCHER PRECISION BEARINGS

...TO THE NORTH AMERICAN MARKET

Proud offspring of the world founder of the ball bearing industry, Fischer Bearings Manufacturing Limited of Stratford, Ontario, is strategically located to service precision bearing requirements in the U.S.A. and Canada.



Engineering and Sales Offices

FISCHER

BEARINGS MANUFACTURING CO.
LOS ANGELES—ORCHARD LAKE, MICHIGAN

FISCHER

BEARINGS (CANADA) LIMITED
MONTREAL, STRATFORD, TORONTO

Distributors across Canada

Ultra High Precision Instrument Bearings • Aircraft Bearings • Industrial Bearings
Water Pump Shaft Assemblies • Steel Balls

SBM-9518



For further information mark No. 132 on Readers' Service Card

Design Notes on Fluid Power

RELEASE NO. 8 — HYDRAULIC PUMPS

All hydraulic pumps must be of the positive displacement type, since their function is to build up pressure in a liquid. They can be classified, according to the way they are powered, into **rotary pumps**, air-operated reciprocating pumps, and hand-operated pumps.

Rotary pumps, which can be driven by electric motor or internal-combustion engine, are the most commonly used in industry, particularly gear pumps, vane pumps and piston pumps.

Gear pumps have the lowest volumetric efficiency, and are seldom used above 500-800 psi. Since the effect of wear is cumulative, efficiency will drop off rapidly as wear occurs. The principal use is in mobile equipment.

Vane pumps of improved design are now dominating the market, particularly for plant use, and are on the way to supplant gear pumps on mobile equipment. The better-designed units are wear-compensated, and have a life expectancy up to 10,000 hours under ideal operating conditions. They can be used up to 2,000 psi. Some makers offer a variable-displacement model, which gives adequate service up to 1,000 psi in a few applications.

Piston pumps are the aristocrats. Their high volumetric and overall efficiency, and the many ways in which their displacement can be controlled, make them the favourites for reliable operation under all conditions. Radial piston pumps generally work to 2,500 psi, while axial piston pumps are rated up to 5,000 psi for continuous operation.

Hand pumps are always piston-type. Models exist to develop pressures up to 10,000 psi. Do not use them above one-tenth horsepower since few men can deliver more than that except for short periods.

Air-operated pumps are less well-known than their hand-operated cousins. They operate from plant air and deliver hydraulic pressures up to 50,000 psi. They are very economical when properly applied: for proof-testing, burst-testing, clamping, pressure boosting, hand-riveters, C-clamps, hydraulic vises, and other tools, as well as some smaller hydraulic presses. They can also be used as metering and high-pressure injection pumps. Because they maintain pressure automatically, they improve quality control. They can be used with oil, water, kerosene, colloidal solutions, and many chemicals.



MONTREAL
TORONTO



View shows twelve of the many models of air-operated and hand-operated pumps and compressors made in Canada by Rousseau Controls Ltd. Models shown can provide gas pressures to 8,000 psi, and liquid pressures to 50,000 psi.

ROUSSEAU CONTROLS LTD.

640 Decourcelle St., Montreal 30, P.Q.
2149 Yonge Street, Toronto 7, Ont.

For further information mark No. 158 on Readers' Service Card



**COLD HEADED
TO CUT
COSTLY MACHINING... *and to provide greater strength!***

When a part is cold headed, rather than machined from bar stock, the saving in material is immediately evident and may reach as much as 60%.

Although varying with the individual design, cold heading production rates are always faster than machining rates for similar pieces, and the process offers the further advantage of increasing the tensile strength and toughness of the

material, and the durability of the finished part.

Wire up to 1" in diameter, of any forgeable metal, can be upset to at least 4½ times its original diameter. Secondary operations such as flattening, bending, threading and punching can be added. Let Stelco's Engineers advise if parts you are now machining can be produced more profitably by cold heading.



THE STEEL COMPANY OF CANADA, LIMITED

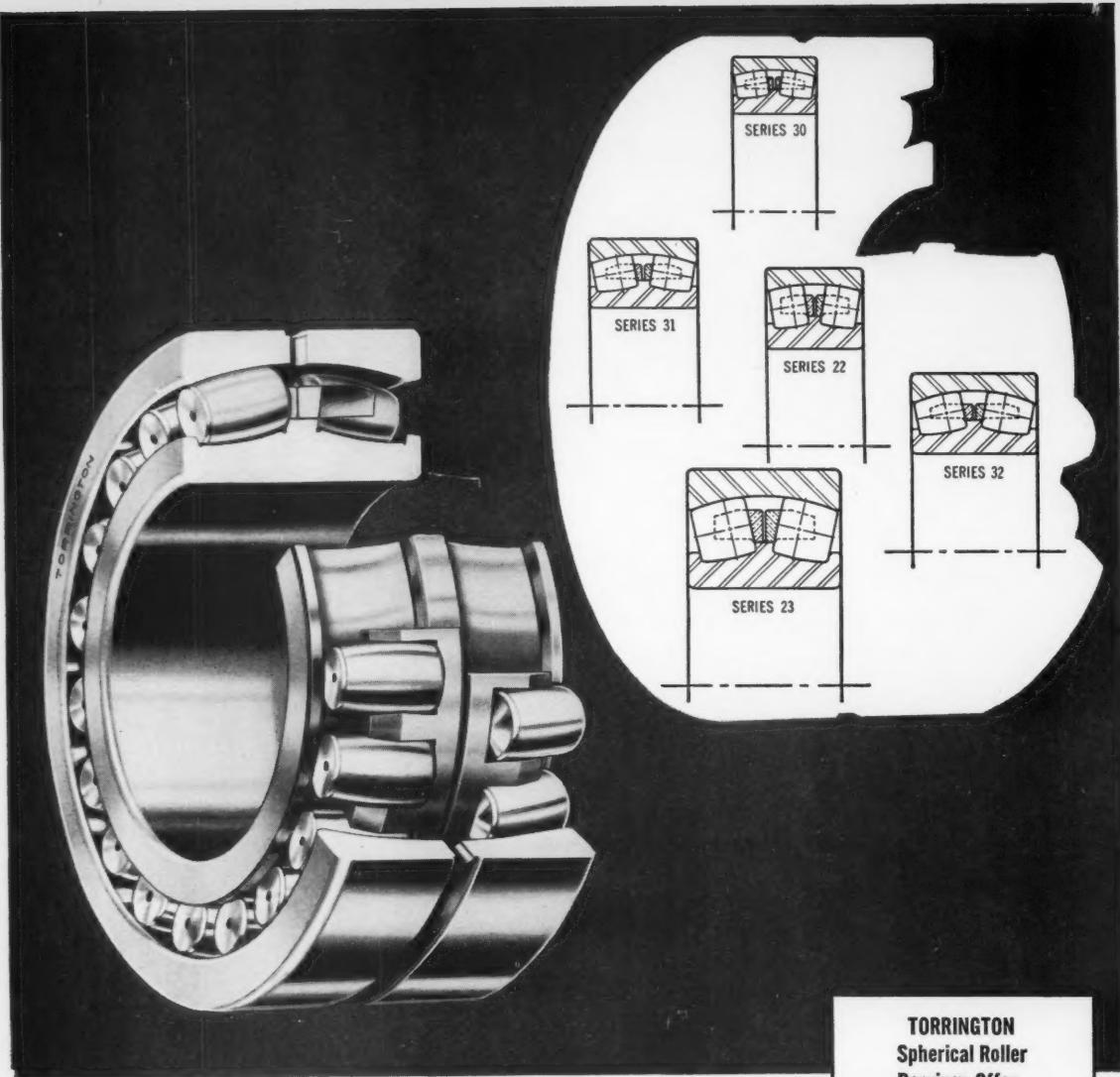
Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.



59191.B

For further information mark No. 163 on Readers' Service Card



There's a Torrington Spherical Roller Bearing for your application

Bearings matched exactly to the job pay off in better performance, longer life, greater reliability. That's why it pays to specify carefully. And that's why it pays to choose Torrington Spherical Roller Bearings.

Whatever your space limitations or capacity requirements, the five series of Torrington Spherical Roller Bearings provide the right bearing for virtually every industrial application. You can design for straight bore or tapered bore with adapter. You can benefit from extra features such as lubrication groove and oil holes, or selected outside diameters.

Your use of Torrington Spherical Roller Bearings will assure exceptional operation and longer bearing life under the toughest conditions. They're made to Torrington's own uncompromising standards—the highest in the field of anti-friction engineering—by the manufacturer of every basic type of anti-friction bearing.

TORRINGTON Spherical Roller Bearings Offer:

- conformity of rollers to raceways
- integral center guide flange for stability
- positive roller guidance
- land-riding bronze cages
- maximum radial and thrust capacity
- controlled internal clearance
- electronically selected rollers
- inherent self-alignment
- even load distribution
- long, dependable service life

Send for new Torrington Spherical Roller Bearing Catalog #258

progress through precision

TORRINGTON BEARINGS

THE TORRINGTON COMPANY, LTD. 925 Millwood Road, Toronto 2, Ontario

For further information mark No. 169 on Readers' Service Card



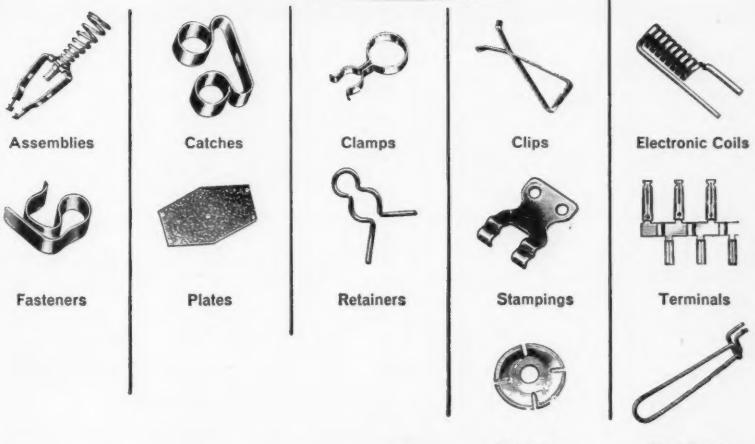
springs

and other things

These are just a few examples

of the many thousands of different springs produced by Wallace Barnes in lots of a few . . . or thousands. The successful production of this large variety depends on the knowledge and experience of the Wallace Barnes team of engineering experts. These men, skilled in every phase of spring-making, guarantee the most efficient design, the most durable product, and the most economical production in any quantity.

Send for your FREE copy of "Pocket Guide to Springs and Other Things". A pictorial guide of our products and services.



Just call the man

from Wallace Barnes

The Wallace Barnes Company Ltd.

Hamilton, Ontario—Montreal (Pointe Claire) Quebec

Sales Agent: E. A. Tipping Sales Ltd., Winnipeg—Vancouver (Richmond)

For further information mark No. 175 on Readers' Service Card

DESIGN ENGINEERING APRIL 1961

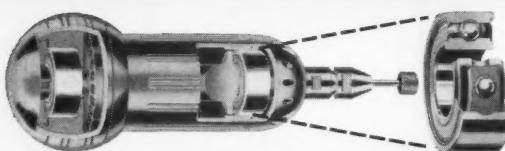


Subsidiary of
Associated Spring
Corporation

64-269

BARDEN PRECISION BALL BEARINGS

If your product needs bearings with close mounting tolerances, high geometrical accuracy, low torque or low vibration . . . if it operates at high speeds or high temperatures . . . specify *Barden Precision*.

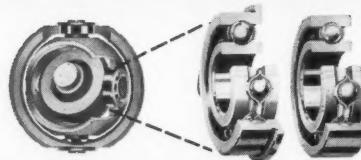


For synchros: Volume produced precision bearings with extra-large outer rings designed to serve as end caps, thereby reducing synchro complexity and cost and increasing air gap accuracy. Barden-developed synchro bearings have closely controlled radial play and minimum eccentricity to meet tight air gap specifications. Sizes from .3750" to 2.0000" O.D.

For less difficult applications, the consistent quality, predictable performance and reliability of *Barden Precision* ball bearings can cut your assembly time, rejection rates and teardown costs.

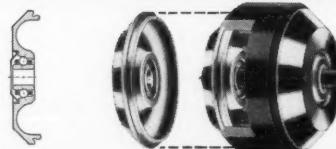
For gear trains: Barden standard low torque bearings with closely controlled radial play and low eccentricity assure minimum backlash. Precision flanges provide accurate positioning surfaces and permit through-boring, eliminating the need for housing shoulders and reducing manufacturing and assembly costs. Sizes from .1562" to .8750" O.D.

For power tools, aircraft and missile accessories, and other high speed applications: Barden "T" retainer bearings with high load capacity and long, trouble-free life. Double shielded, grease lubricated "T" retainer bearings have operated more than 6,000 hours at 80,000 RPM. Sizes from .5000" to 3.3465" O.D.



For gyro gimbals and other torque-sensitive devices: Barden "W" retainer reduces torque peaks and eliminates retainer lock. "W" retainer bearings save one gyro manufacturer \$100 per unit by reducing costly teardown. Sizes from .1562" to .6250" O.D. Also other standard and special design gimbal bearings, including the Barden Dynamic Bearing with near-zero torque.

For gyro rotors: Barden special design end-bell bearings to increase accuracy and reduce assembly cost of miniature gyros. Bearings become part of spin mass and serve as end caps for wheel assembly, reducing mating part errors and improving squareness, concentricity and overall accuracy. Sizes from .615" to 1.016" O.D. Also other standard and special types including inertial gyro bearings with 20-microinch tolerances.



For memory drums, high precision spindles and other low run-out applications: Barden duplex pairs with extremely low eccentricity and non-repetitive runout. Matched pairs with accurately controlled preload provide high load capacity, smoothness and long life along with radial and axial rigidity. Sizes from .3125" to 3.3465" O.D., deep groove or angular contact.



Major manufacturers of instruments, mechanical components, computers, spindles and aircraft accessories regularly specify *Barden Precision* ball bearings for high performance mechanisms.

To specify *Barden Precision* ball bearings—prototype, pilot run or large volume production—ask for a Barden sales engineer to give you on-the-spot assistance, or write for Catalog C-3.

for reliability...specify

BARDEN



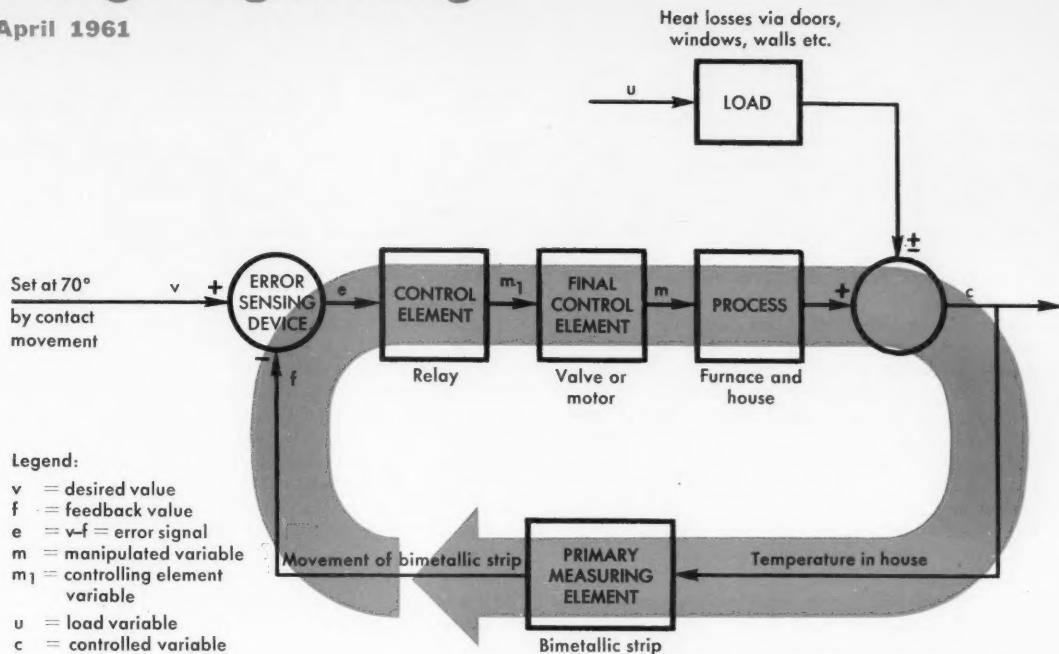
PRECISION BALL BEARINGS

PHILIP FRENCH SALES, LTD. — Exclusive Agent in Canada
8425 Mountain Sights Avenue, Montreal 16
57 Dromore Crescent, Willowdale, Ont.

For further information mark No. 108 on Readers' Service Card.

Design Engineering

April 1961



House heating system fitted into the general diagram for any closed loop. General designations are in block letters . . . house heating system in lower case letters.

Can you define process control terms?

Roy Horney, B.A., Director of Instrument Technology at Toronto's Ryerson Institute, gives an easy guide for understanding the terms used in process control theory and instrumentation

One simple way of explaining the various terms in **process control** instrumentation is to consider a simple **closed loop** system, such as used in a home heating installation. The illustration above is a schematic of such a **closed loop** system. On it are given the general designations which could be made to apply to any process system, and the specific designations which apply to the home heating system.

We all have a desired temperature for our house. This we refer to as the **set point**. The actual temperature of the house is the **controlled variable**. The difference between these two is the **deviation**, and this deviation may be either positive or negative, that is, above or below the **set point**. The temperature must be measured, and it is quite probable that the value, called the **feedback**, which is fed to the **error sensing device** differs from the actual temperature. Nevertheless it is the difference between this value and the **set point** which is fed to the **controller**. This is called the **error signal**. Suppose the **set point** is 70, the **error signal** is 70 minus **feedback**. If this error is positive and greater than some finite amount, then fuel will move to the furnace, be ignited, and the house will begin to warm up.

Many factors affect load

The time that the furnace stays on will depend on many factors, including the size of the house, size of

furnace, outside temperature, wind velocity, door, and windows, thermal conductivities of the walls, ceiling and floor. These constitute the **load** on the **process**. — your house — and for a given **load** the process will be characterized by a **time constant**. This **time constant**, like others connected with the **final control element**, **measuring element**, and the various parts of the **controlling element**, could be used as the basis of a mathematical treatment of this **closed loop** system to determine, even before it is built and put into operation, how the system will operate. Also, instead of the standard mathematical treatment, it is possible to simulate the system with an analog computer to determine how it will work.

As was stated above, the **deviation** has to be positive and greater than some finite amount before fuel will move to the furnace. This is because the **controlling element** in a house is an **on-off controller**. The **error sensing device** associated with this type of controller requires power to operate it, or some additional movement to take up the slack in the linkage. Thus the **feedback signal** must fall below the **set point** before fuel moves and must rise above the **set point** before the fuel will stop moving. The difference between these values above and below the **set point** is the **differential**, and it is a characteristic of the **on-off controller**. Because there is a **differential**, the **controlled variable** will **cycle**, that is, the temperature will rise to some value (say 72 deg.) and then fall to some value (say 68 deg.) in a periodic manner. For a given steady **load**, the **cycle** will be regular. If the **load** should vary, both the amplitude and period of the **cycle** may vary.

What about time delay

Even though the **load** may be constant, with an **on-off controller** the **controlled variable** may go below the value at which fuel starts to move, or may rise above the value at which fuel stops moving. This may occur for two reasons. First, the **controlled variable** may not equal the **feedback signal**. Second, heat will still be coming from the furnace after fuel has stopped moving to it, and the temperature will continue to rise, or alternatively, heat will not come from the furnace immediately fuel starts to flow to it, and the temperature will continue to fall. If the **process** has a large **time constant** (the time it takes the temperature to change by an amount equal to 63.2% of the total change) then we can use an **on-off controller**, because during the time mentioned above little change will take place in the **controlled variable** and it will have departed little from the **set point**. Thus we will have reasonable control of the temperature. However, if the **process** has a small **time constant** then the temperature will change a large amount during the lag time and we will have poor control. Another way to discuss this is to refer to the **process reaction rate**. A large **time constant** is associated with a slow **process reaction rate**, and a small **time constant** with a fast **process reduction rate**. It is possible to have an increasing **process reaction rate** different from the decreasing **process reduction rate**. In this case the **cycle** will be irregular.

Suppose there is a slow increasing **reaction rate** and a fast decreasing **reaction rate**. The temperature will rise little above the **set point**, but may fall far below it. Whether or not we can tolerate this will depend on the

process. Generally speaking, a **process** with a slow **process reaction rate** in both directions and a relatively constant load can be effectively controlled by an **on-off controller**, which is normally a simple device.

Other types of controllers

Other types of controllers are needed for industrial processes, processes which have fast **process reaction rates** and **loads** that vary. A **proportional controller** may be used for those applications where **cycling** can not be tolerated. This type of controller works in conjunction with a **final control element** which can pass varying amounts of fuel and need not be used in the fully opened or fully closed position as is the **final control element** used in conjunction with the **on-off controller**.

The word **proportional** comes from the fact that the movement of the valve stem from the preset position is **proportional** to the **deviation** of the **controlled variable** from the **set point**. If a **deviation** equal to 50% of the range of the temperatures controlled will cause a 100% movement of the valve stem, then we say we have a 50% **proportional controller** and we talk about a 50% **proportional band**. Depending on the particular make of the controller we may talk about **throttling range**, **sensitivity** or **gain**. All of these are concerned with the constant of proportionality between the **deviation** and the movement of the valve stem from the preset position.

The preset position of the valve stem is dependent on the **load**. If the **load** changes, the valve will not be at the position to give the right amount of fuel and the controller will not be able to bring the **controlled variable** to the **set point**. This results in **offset**, a steady **deviation** of the **controlled variable** from the **set point**, which is maintained so long as the **load** stays at this new value. This, of course, is not desirable. We would like the **deviation** to be zero for most of the time.

There are two ways in which we can get rid of **offset**. The first involves making the valve stem move more for a given **deviation**, that is, making a change in the constant of proportionality that connects the **deviation** and the movement of the valve stem. Making the valve stem move more is accomplished by reducing the **proportional band** or increasing the **sensitivity** or increasing the **gain**. If the **proportional band** were made so small that **deviation** required to move the valve stem through 100% of its travel were of the order of the **differential** then we would have changed our **proportional controller** back into an **on-off controller**. We would have removed the **offset**, but we would have reintroduced the **cycling**. If the **offset** were not too large, then it might be possible to remove it by reducing the **proportional band** without re-introducing the **cycling**.

If the **offset** is large, then it is necessary to use the second method. This involves changing the preset position of the valve stem to match the new load. If this is done manually, then we say we have a **proportional controller with manual reset**. Controllers have also been developed to do this automatically. These are called **proportional plus automatic reset** or **proportional plus reset** or **proportional plus integral controllers**.

Now that we have taken care of the **offset**, we are able to control processes that are subject to **load** changes, but unfortunately, only those **load** changes that



happen slowly. To handle faster **load** changes, we need a controller which will respond quickly if the **controlled variable** is changing quickly and yet not lose the responses we have built into it to handle the **cycling** and the slow **load** changes, adding a response to the controller which will move the valve an amount proportional to the rate of change of the **controlled variable**. This type of response is called **rate of derivative response**. It cannot be used by itself, for the variable could be at any constant value and this response would not change the position of the valve stem. It is used in conjunction with **proportional controller** to give the **proportional plus rate controller** and in conjunction with the **proportional plus reset controller** to give the **proportional plus reset plus rate controller**.

Normally these controllers are shown on a flow sheet as a circle or rectangle with the designation C for controller preceded by one or two other letters. The first indicates the variable being controlled, the second indicates whether a record of the variable is being made or only an indication is being given.

It gets more complicated

The output of the controller goes to a **final control element**, which in many cases is a valve. Now valves have different characteristics depending on their use. **Characterization** means the relation between the flow through the valve and the position of the valve stem. A **linear** characterization is one in which the relationship between flow and position is **linear**. It is customary to talk about valve stem **travel** rather than valve stem position. If a valve with a **linear** characteristic were half open it would be passing 50% of the maximum flow. If the stem were then moved 10% of its **travel**, the valve would pass either 40% or 60% of the maximum flow. This type of characteristic has certain applications in temperature control of liquid processes with large **time constants**, in **level control** and in **pressure control** where the ratio of the maximum to minimum loads is less than 3 to 1.

If the ratio of the maximum to minimum loads is greater than 3 to 1, then it is advisable to use a valve with an **equal percentage** characteristic. This is one in which the % change in travel, taken as a % of the total travel, is equal to the % change in the flow, taken as a % of the actual flow. If we had the valve open so that the valve was passing 50% of the maximum flow (this does not correspond to a 50% movement of the valve stem) and we changed the stem by an amount equal to 10% of its travel, the flow would change by 10% of 50% or 5%. This means that good control is possible even when the valve is nearly closed, as would be required when the ratio of the maximum to minimum loads were greater than 3 to 1.

For **on-off** control, a valve with a **quick opening** characteristic is used. This characteristic is such that the valve is almost fully opened after a very small movement of the valve stem.

The **rangeability** of a valve is the ratio of the maximum controllable flow to the minimum controllable flow. Knowing the **rangeability** of the valve and the ratio of the maximum to minimum loads on the **process**, it is then possible to determine whether or not the valve will

give good control. In practice it would not be wise to use the maximum controllable flow since that would mean the controller could not work effectively to get the **controlled variable** to the **set point** at the maximum **load**. A normal flow of about 70% of the maximum controllable flow is used and the ratio of the **normal maximum controllable flow** to the **minimum controllable flow** is called the **turndown**.

More about valves

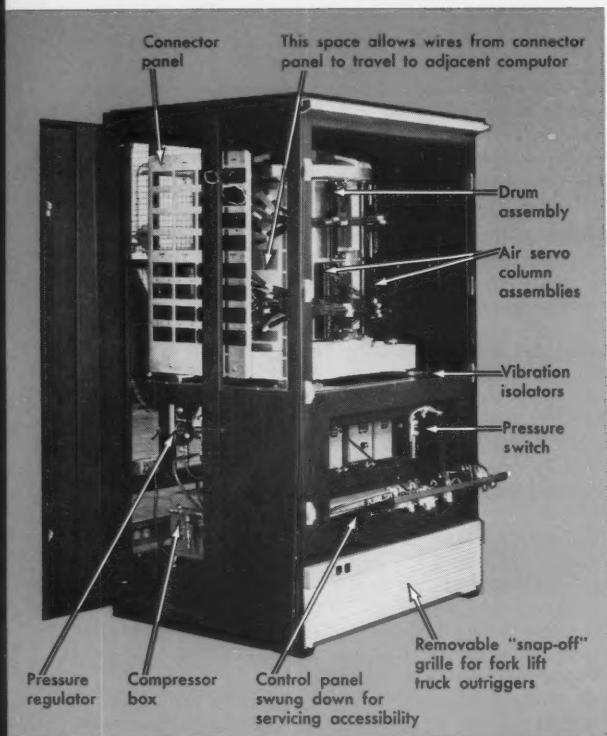
Other terms associated with spring opposed diaphragm operated valves are **air to open**, **air to close**, **direct acting** and **reverse acting**. An **air to open** valve has a fail-safe property when used on a heating line. If the air should fail, the valve will be closed by the spring and the heat will be shut off. A **direct acting** operator is one which moves the valve stem toward the valve when the pressure to the diaphragm chamber is increased. The choice of **direct** or **reverse acting** is normally dependent on space available or on the need for changing a valve already installed from **air to open** to **air to close** or vice versa.

A valve may be some distance from the controller. There is need then for a **transmission line** running from the **controller** to the **valve**. If an air signal is being sent to the valve then the valve will not move exactly in step with the signal from the controller. For example, if the controller were sending out a sinusoidal signal, its **amplitude** and **phase** would be different at the valve. These differences can be calculated using the **pneumatic resistance** of the transmission line and the **pneumatic capacitance** of the diaphragm chamber. The time constant associated with this pneumatic transmission line can be reduced by converting the output of the controller into an electrical signal, sending the electrical signal to the valve and reconverting it back to an air signal to operate the valve. Alternatively an electronic controller could be used which would give an output in the form of an electrical signal directly.

There is always a **time constant** associated with a transmission line, but running a transmission line of this type is certainly preferable to running a capillary tube from the **process** to the controller, or running the lines from the pressure taps for an orifice plate from the pipe carrying the product to the controller. In both cases **transmitters** can be used which will convert the **temperature signal** or the **flow signal** into an **air pressure signal**. If we convert to electrical signals we get a greater reduction in the **time constants**. These devices which convert one type of signal into another type of signal are called **transducers**. The ones most used in the process control field are the **differential pressure transmitter**, **temperature transmitter** and the **electro-pneumatic transducer**.

These, then are some of the terms and symbols associated with the field of **process control** instrumentation. The complete list goes on almost ad infinitum. However, most control system can be fitted into the general diagram for the **closed loop** system which we introduced in our first paragraph. This system, as we have seen, is closely allied to the ordinary heating system used in our Canadian homes, and relatively familiar to all of us. *





Canadian designed magnetic storage unit for Combat Logic Network System will aid U.S. defence communications.

units were manufactured at a total project cost in excess of \$300,000. The contract was awarded to the Canadian company only after close bidding in the US open market. It was subsequently learned that the use of air servo columns, which Ferranti have pioneered in this field, was one of the major deciding factors.

Maximum accessibility for servicing

The magnetic storage drum assembly is housed in the upper half of a sheet metal cabinet, the design of which is compatible in outside appearance with those in use on the balance of RCA's overall system. The pneumatic and electrical operating systems are located in the lower half of the cabinet, plus at the front, the operating and control panel. The circuits are designed in such a manner that operation and control may be effected from either this self contained panel or a remote supervisory console.

The cabinet doors at front, rear and one side are removable, affording almost unlimited access for servicing of the drum assembly and associated equipment. Interlock switches on all doors are connected to a red warning light on the remote console to indicate the opening of any door. As an added precaution against unauthorized tampering of such specialized equipment, all doors are provided with locks.

For ease of shipment and ready replacement in case of failure, the storage drum assembly is easily removable from the cabinet by means of a fork lift truck. The minimum life expectancy of the entire unit is ten years with periodic servicing kept to a minimum. In the event of a catastrophic failure of the drum, the entire assembly is a spared item, due to the special assembly techniques and fixtures required to maintain the close dimensional accuracies inherent in such a device.

Bearings checked out

The brake and motor is an integral assembly, mounting under the base of the drum and permitting removal even when the drum unit is installed in the cabinet. The motor takes 70 seconds to bring the drum rotor to full speed, and is capable of three successive starts within one-half hour. The brake is automatically applied when the power is removed from the motor, and takes a further 70 seconds to stop the rotor. Upon application of power to the motor, the brake is automatically released. A manual device is provided to cut out the brake at will for purposes of determining a "run-down time" check on the bearings from full speed of the rotor. However, the feature of automatically reverting to the original sequence of brake operation is also incorporated.

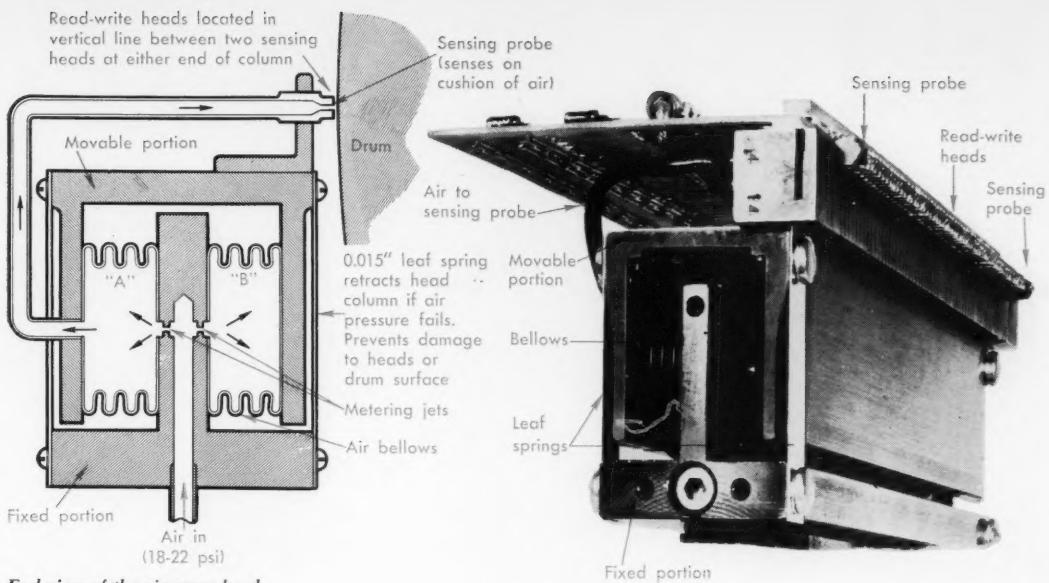
In addition to this conventional "run-down time" check on the bearings, a vibration pick-up transducer is incorporated so that a bearing failure may be anticipated, thus avoiding a failure to the drum assembly. The transducer is essentially a crystal, which when acted upon by an outside force (in this instance, a vibration) produces a voltage which in turn may be read as a physical displacement by a recording pen.

Canadian design scoops the world

How engineers at Ferranti-Packard, Toronto, designed and built a magnetic memory drum . . . as told by George Hayhurst, P.Eng.

Canadian firms in the electronics and instrument manufacturing industry can and do win contracts for the design and construction of equipment, even against world-wide competition. For instance, a magnetic drum unit, designed and made by Ferranti-Packard Electric Limited of Toronto, will be installed throughout the USA in the ComLogNet system. Even the special production machinery required for the job was also designed and built in Toronto.

The customer was the Radio Corporation of America, located in Camden, N.J., for whom seventeen



End view of the air-servo head column and a schematic drawing of the column operation.

When this displacement reaches certain limits, it may be interpreted as progressive bearing failure or contamination.

Rotor manufacture

The magnetic drum assembly is basically an 18½ in. diameter aluminum drum, 24 in. long and rotating in a vertical plane on precision angular contact bearings. The lower bearing is preloaded at approximately 300 lbs by the weight of the rotor, whilst the top bearing, a d-b pair, is permitted axial freedom to accommodate dimensional changes due to temperature fluctuations and manufacturing tolerances. Both sets of bearings are oil wick fed from individual reservoirs, containing Shell Tellus 15 oil.

Surrounding the rotating mass is a baseplate, mounted on four vibration isolators, an outer shell on which are mounted the air servo columns, and a top plate. The inside surfaces of these three aluminum sand castings are machined smooth for the purpose of hygienic conditions in the vicinity of bearings and rotor. The castings are from Alcan 135-T6, chosen for its excellent castability and resistance to chemical attack as well as good machining characteristics. Good mechanical properties are developed after heat treatment to condition T6. In addition, good dimensional stability under temperature fluctuations is a feature. Casting was by the Aluminum Company of Canada.

The aluminum rotor is fabricated from a hand forged billet which is machined into a shell with a 1½ in. wall thickness. A centre plate and end plates are shrunk inside. The hand forged billet (Alcan 26S-T5) ensures a suitably homogenous "skin" thick enough to withstand machining and leaves a smooth surface free from blow holes and pitting. This is most essential in the application of the magnetic dispersion when a finished thickness of .0012 in. \pm .0005 in. is required. The rotor is then horizontally bored at

each end and finished stub shafts shrunk in the end plates.

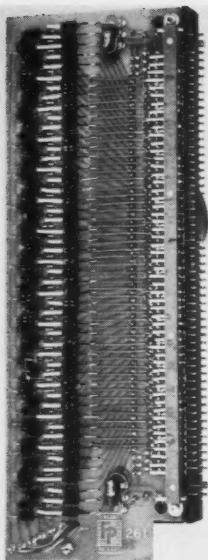
Critical finish machining

From this point on, any subsequent finish machining of the drum face is carried out in a vertical plane and with the rotor mounted on its own bearings. The rigorous concentricity and straightness tolerances ($\pm .0001$ in.) laid down by the specification preclude the use of any conventional horizontal turning machine since with a mass of such size and weight, it is inherent that some untenable sag will take place.

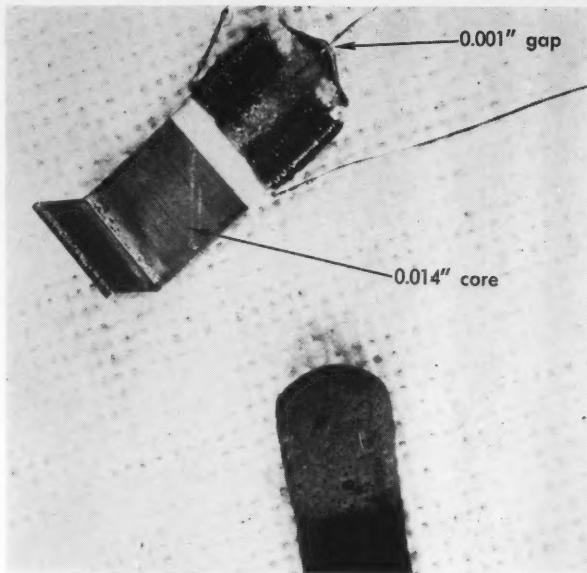
The Ferranti-Packard standard air servo column extends over a length approximately equal to half the drum length. By stacking the servo columns two high, the entire drum length may be covered. Because of this, and since the drum surface straightness tolerance is required only along the length of an air servo column, the drum may now be considered as two elements. The two half lengths are machined simultaneously using two cutting tools. At a later stage, that of machining the magnetic dispersion with a diamond tool, it is an unfortunate fact that the diamond tool lasts for only half of the drum anyway, without further dressing and set up.

A special vertical turning machine, designed and built for Ferranti by Barker-Thorne Ltd., Toronto, is used exclusively for finish turning all memory drums (except air bearing drums). It can accommodate drums down to 3 in. diameter by 3 in. long.

The success of final turning depends mainly upon the orientation of the bearing housings in the machine. This orientation is maintained until completion of the rotor assembly. The final machining removes the bare minimum of material — just sufficient to clean up the entire drum surface. For subsequent reference, shallow grooves of any known depth are machined at each end and the centre of the drum face. At this point, the drum is removed from the machine and



The read-write head column including the head switching matrix.



A typical read-write head, upper left compared to safety-match head.

dynamically balanced to within .05 inch-ounce. After balancing, the drum is placed in a horizontal cradle and the surface chemically etched in sodium hydroxide. After washing with water, it is located vertically on a rotating turntable and sprayed with twenty coats of Reeve's Soundcraft Grimaco (Grindable Magnetic Coating). Each coat applies approximately .0015 in. thickness and a waiting time of ten minutes between coats allows the volatiles to evaporate. After the final coat has been applied, batteries of heat lamps are used around the rotating drum for the baking process.

Temperature sensitive papers are attached to the drum surface to monitor surface temperatures. With the heat lamp method of baking there is less likelihood of excessive heat penetration and consequent warping of the now accurate drum surface.

The drum is returned to the vertical turning machine and the bearings oriented as before. The three witness grooves (masked during coating process) provided in the previous machining operation, give a datum from which exact dispersion thickness may be determined and machined. This is the final machining operation of the drum.

Upon removal from the machine, the entire bearing assemblies are dismantled, washed in a mixture of filtered light machine oil and toluol and reassembled with new bearings. Assembly of all precision components such as these is performed in a white room where temperature, humidity and dust are carefully controlled. The drum and bearing assemblies are then installed in the aluminum casing, bearing reservoirs filled with filtered light turbine oil, and given a running test after the brake and motor assembly has been installed.

Air servo column design

Eight air servo column assemblies are now ready to be mounted to the outer shell and connected to

the compressed air system. Such an assembly comprises an air servo column, attached to which is a head column containing 64 magnetic read/write heads. The heads, hand wound and potted in an epoxy, are mounted on the head column and aligned with two sensing probes, on a shadowgraph. The head column maintains the alignment whilst the air servo column maintains the head to drum spacing within extremely close limits ($\pm .0001$ in.) when mounted in position on the drum assembly.

With the air pressure off, the fail-safe feature of the air servo columns retracts the heads from the drum, ensuring no damage to the drum surface or read/write heads. The pneumatic system features dual, oil-less, doubling acting air compressors. A selector on the control panel enables either one to act as the main supply and in case of failure, the standby compressor is automatically switched into the system, indicating an orange "fault" light on the remote console. It is recommended that each compressor be used as the main supply for periods of about three to six months in order to use them evenly.

In the event of a serious drop in air pressure (less than 18 psi), a red warning light plus an audible alarm come into effect on the remote console. In such an instance, the air servo columns retract from the drum surface.

This magnetic storage drum, so far as is known, is the largest of its type to be built. The handling alone, from manufacturing operation to operation is in itself a problem, particularly at the finishing stages where extreme care and cleanliness are necessary to obtain successful results.

Underlining the general use to which this equipment may be employed, considerable interest has been shown both in Great Britain and the United States with the possibility of further orders for similar units from both countries. *



Preview

June 5 to 8, 1961



Instrument Society of America's

Canadian instrument—automation show

First to be held in dominion — exhibits from the world over

The Conference

The Instrument Society of America operates four regional conferences annually and this year the **1961 Summer Conference on Instrumentation—Automation** will run concurrently with the Instrumentation Exhibition being held in the Queen Elizabeth Building in the Exhibition Grounds in Toronto.

A total of twelve Conference Sessions will be held, according to their present plans. If demand warrants it, and the speakers are available, more sessions will be added. Papers are presently being developed for the sessions, and indications are that those attending will hear the topmost experts in each of the subjects. Advances made in instrumentation, new materials, new techniques, new components and design problems will all be considered.

Themes for Sessions

A rundown of the planned sessions includes:

Monday, June 5

- Keynote Session
- President's Reception

Tuesday, June 6

- Management
- Chemical and Petroleum Instrumentation
- Power Instrumentation
- Automotive Instrumentation

Wednesday, June 7

- Pulp and Paper Instrumentation
- Metals and Ceramics Instrumentation
- Feedback Control Systems
- Underwater Instrumentation

Thursday, June 8

- Analysis Instrumentation
- Data Handling and Computation
- Measurement and Control Instrumentation
- Physical and Mechanical Measurement

The Exhibition

Design engineers will find this a most interesting show. The ISA has been organizing these shows for years—but this is the first time one has been brought to Canada. Technical experts from practically all of the companies exhibiting will be on hand to give advice, answer questions, demonstrate their equipment, and help make the whole show one that must not be missed.

Some of the exhibitors

The list of those taking part in the Exhibition reads like a "who's who" of world instrumentation. Here's a partial list of some of the exhibitors:

American Machine & Metals	F & M Scientific
American Standard Controls	Fischer & Porter Canada
Automatic Electric Sales	Fisher Governor
Automatic Switch Company	Foxboro Company
Aviation Electric Limited	General Electric Company
Baker Instruments Limited	Hagan Corporation Canada
Barton Instrument Corporation	Imperial-Eastman Corporation
Beckman Instruments	George Kent Canada
Bristol Company of Canada	Kirk Equipment
Brooks Instrument Company	Leslie Company
Canadian Control and Instrumentation	Measurement Engineering
F. W. Chambers & Company	Milton Roy
Computing Devices of Canada	Minneapolis-Honeywell
Conoflow Corporation	Ontor Limited
Coulter Industrial Sales	Peacock Brothers
Davis Automatic Controls	R-O-R Associates
Daystrom Limited	Taylor Instrument Canada
Electronic Corporation	Thermo Electric Canada
Emcor Ingersol Products	Thermovolt Instruments
	United Electric Controls
	Wallace & Tiernan

Some space is still available, although approximately 100 companies have contracted to take part. Enquiries concerning the show should be forwarded to the ISA Exhibition, c/o R. J. Reeves, P.Eng., 1650 Yonge Street, Toronto.

Plan now to attend this technical show—keep up with what's new in automation

Time cycle charts

Save time and effort in design work

G. G. Siposs, P.Eng., an authority on design and manufacture of timer switches, explains the advantage of using time cycle charts

Machine and instrument designers often find that a visual means of showing a cycle of operations would greatly facilitate representing the actual operation and also assist in design work. A simple system, known as time-cycle charts, has been in use for some time. It is a system which many engineers find most invaluable. Here are some of its main advantages:

1. "On" and "off" times can be easily visualized. Periods when switches are energized, for instance, are simply identified.
2. The action of the different components of the whole mechanism or operation is represented graphically.
3. The design of a sequence of operations is simplified and made faster.
4. With the aid of an accompanying diagram, the actual operations are easily visualized; this reduces time required for troubleshooting.
5. Should modifications become necessary, parts which lend themselves to adjustment are readily apparent. Effects these adjustments will have on the whole system are also easily identified.
6. Cams, and/or circuits, can be designed more easily.

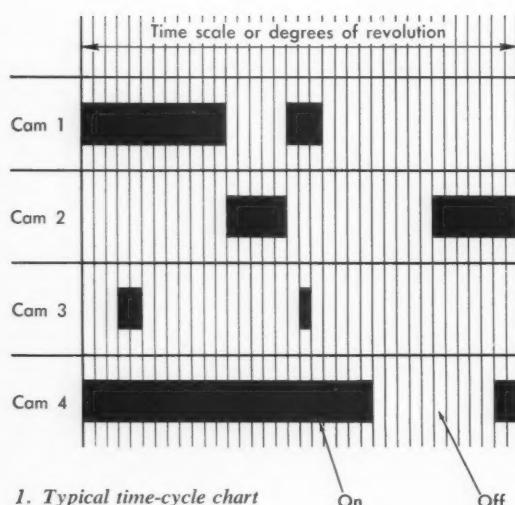
By the use of mechanical-electrical analogy the system can be employed on purely mechanical machines as well as electrical circuits. Pneumatic systems are usually controlled by microswitches and where several switches are employed it is often difficult to plan the sequence of operations without a time-cycle chart.

The basic process

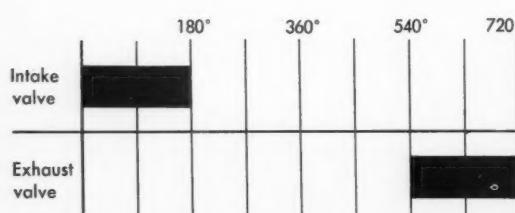
The basic process consists of showing on a horizontal time chart the program built into a control mechanism, such as a cam. If several cams actuated switches are used, these graphical representations are placed parallel to each other so that they all start from the same position representing the start of the cycle. The length of the time scale is arbitrarily chosen to some convenient period.

Unless an absolute measure of time is required (such as in industrial processes where timing to the nearest fraction of a second might be important) the time scale is usually divided off in equal parts. These parts, or intervals, are represented by vertical lines indicating degrees of revolution, minutes, seconds, etc. Any two operations that start, change or finish simultaneously show this change at the one vertical line. "On" periods may be shown by heavy lines while "off" periods need not be marked at all.

Let us now consider an actual example: the opening and closing of the valves in an internal combustion engine, an operation with which practically all of you



1. Typical time-cycle chart with time divided into regular intervals of degrees or seconds.



2. In a four cycle engine one complete cycle takes in 720 degrees of rotation.

will be familiar. Note that in a four-cycle engine one complete cycle takes in 720 degrees of rotation, and this is shown in the horizontal scale.

To achieve higher volumetric efficiency, different valve openings are used. When the intake valve opens, for example, in one of the cylinders of a four-cycle engine, the fuel/air mixture moves into the cylinder under the pressure of the outside air. When the valve closes, the mixture continues to move due to its inertia and the particles pile up in a denser mixture around the valve and the valve pocket. At this time one of the other intake valves should open to permit this mixture to enter the other cylinder.

Although this second cylinder is just finishing its exhaust stroke and theoretically is not ready to receive a new charge, the higher pressure of the first 'slug' of mixture is sufficient to produce a slight supercharging effect, thus ramming it into the number two cylinder. Similarly, when one of the exhaust valves closes, the outgoing gases create a suction in the manifold.

Therefore, if one of the other valves opens slightly ahead of its theoretical opening time, the partial vacuum in the manifold will suck out the burnt gases from that cylinder. This permits more mixture to enter the cylinder, with a consequent higher volumetric efficiency.

In figure 7 we show a graph of several specially ground racing camshaft actions for just such a motor operation. A cycle chart is eminently suited for comparing these actions.

Electrical switching application

As an example of electrical switching we will consider a mixing machine, consisting of two solenoid valves, one for substance A, and the second for substance B. To obtain the different concentrations required, we simply change the "on" time of the valve. This is a typical automatic vending machine application, such as is used for beverages.

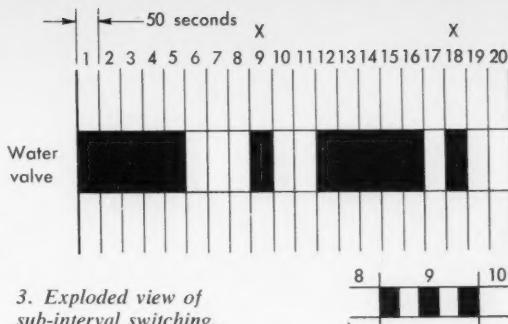
Switching systems usually consist of cams mounted on a camshaft and actuating microswitches. Some cams are made three-level to operate single-pole-double-throw switches. One might then visualize a cycle-chart as the imprint of the high, or low, lobes around the periphery of the cams in the timer switch.

At certain parts of a cycle, sub-interval switching may be required. This means that a given operation is programmed to happen while the shaft is stationary between "jumps". In this case an exploded view of that particular interval is shown below the cycle-chart. This view enables the designer to build a suitable arrangement into the system to bypass the regular advancement of the main camshaft, and to bring an auxiliary camshaft into operation. It is obvious that this auxiliary cam completes one revolution while the main camshaft pauses for one interval.

Cycles for automatic washer

In figure 5 we have the program of an average automatic washing machine. Though it is a greatly simplified chart, the basic components of the cycle are shown. Let us suppose that each interval, represented by vertical lines, has a duration of one minute. It is obvious that it takes two minutes to fill the tub with water.

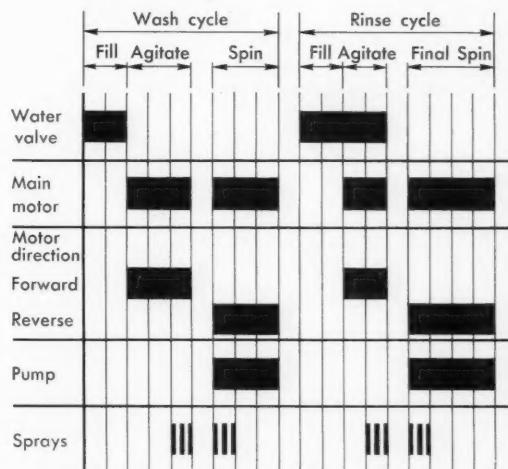
At the end of the fill period the main motor starts up, its direction being determined by the high lobe of the "motor direction" cam. At the end of five minutes the motor stops. During the last minute of agitation three sprays have washed the scum off the top of the tub. After the motor has come to a complete halt (this would actually take less than a minute) it starts up



3. Exploded view of sub-interval switching.



4. Charts are useful for showing the degree of lift that is imparted to a cam follower.

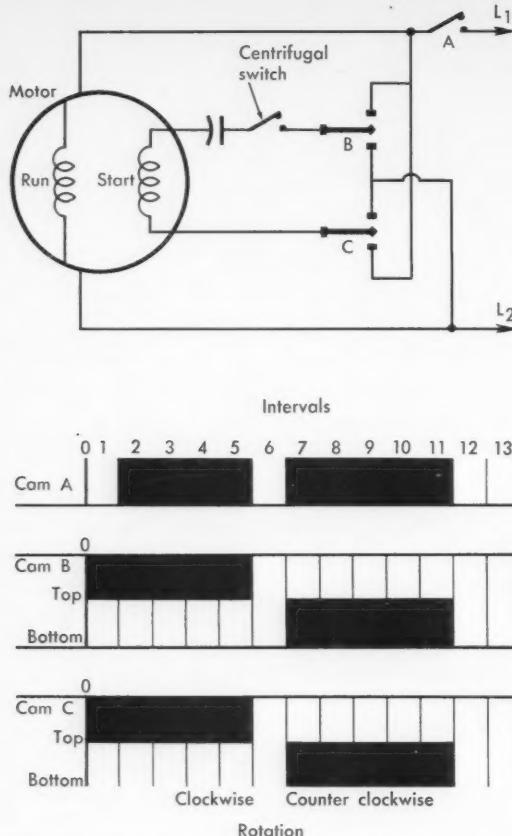


5. Program for a typical automatic washing machine depicts every operation of every component.

again in the reverse direction. It should be mentioned at this point that in most automatic machines agitation and spin are achieved by driving the impeller through a series of gears, a clutch and a sector gear.

When the motor rotates in one direction the sector gear moves the impeller back and forth through an angle of approximately 270 degrees. When the motor rotates in the opposite direction the clutch disengages the sector gear and the inner tub spins. The water is thrown out of the tub by centrifugal force. The rinse cycle is similar with the exception of wash and spin times.

The reversing sequence of a split-phase capacitor start EHP electric motor is shown in figure 6. Cam "A" operates a SPST switch and can be considered the main switch for the system. Cams "B" and "C" operate



6. Combination schematic and time-cycle charts give complete detail of operation of electric motor reversing sequence.

DPDT switches. The top pole of one switch and the bottom pole of the other one are connected by busbars and vice versa. At interval 0 as shown on the cycle chart, cams B and C make contact on their top poles. The motor windings are not energized since the main switch is not closed.

As soon as cam A makes contact, both the starting and main windings are energized and the motor starts. After it reaches running speed the starting winding is de-energized by a centrifugal switch. At this instant cams B and C can be operated in any manner since the starting circuit has no current in it. At the end of the fifth interval, as an example, the main switch is disconnected and the motor stops.

At the beginning of the seventh interval all three cams are energized again, but B and C make contact on the bottom. This results in the motor starting up in the opposite direction. The camshaft advances in steps to ensure simultaneous action of all three switches.

Make-and-break operations

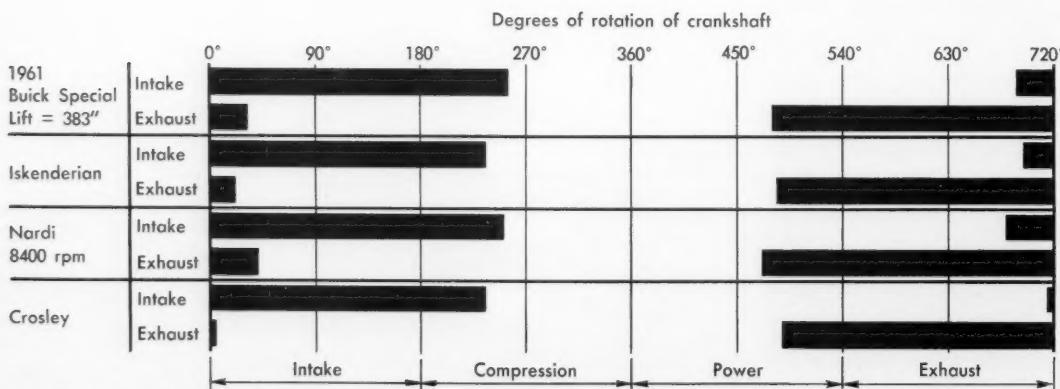
Make-before-break and break-before-make requirements are usually specified by the designer. This may be necessary to prevent parts from interfering with each other.

Time cycle charts are useful for representing movements in human engineering and time study. It's easier to explain "double-clutching" and "down-shifting" (often practiced by sports car drivers) by means of a chart than by an involved piece of prose.

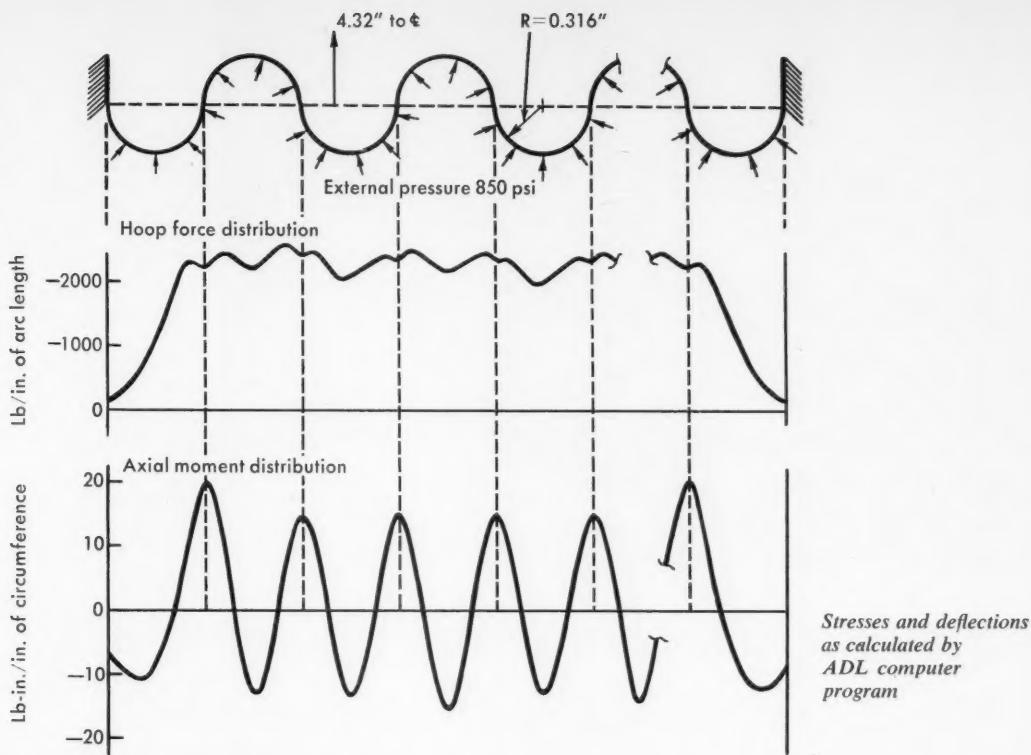
Time cycle charts make it possible to show the degree of lift that is imparted to the follower by a cam. In figure 4 a dwell period of 180 degrees is shown; the cam lifts the follower gradually through 90 degrees, then lowers it gradually to complete the cycle. This type of chart is especially helpful when designing odd shaped cams.

After a machine is assembled and the cams are being timed, time charts come in handy as a ready check. If several bending tools come in contact with a part during the cycle, damage to these parts may be avoided by slowly rotating the shaft (before assembling) to ascertain that the cam action follows that laid down by the designer.

Thus set-up men and maintenance men as well as designers benefit from this simple graphical tool, the time-cycle chart. *



7. Time cycle chart permits accurate study of four specially ground racing car camshaft actions.



Now...ready-made computer programs

Time taken for the analytical portion of a complex shell configuration can now be slashed to a few minutes, thanks to a new computer program

One of the most time consuming tasks faced by many engineers concerns the stress-analysis of elastic shells, such as pressure vessels, bellows, diaphragms and dewars. Increasingly the demands of modern technology involve shell configurations that are not easily amenable to handbook calculation methods; in such cases it is not uncommon for a man-month or more of engineering time to be spent on one particular problem. And very often, one month cannot be spared for this matter.

The solution of such problems has now been simplified by the recent announcement of the development of a general shell computer program that applies to any shell of rotational symmetry. This program reduces the analytical portion of even the most complex problems to a few minutes of computer time.

Known as the ADL Shell Program, it is designed for high-speed digital computers. It performs a complete stress and deflection analysis for any thin elastic shell of rotational symmetric form subjected to arbitrary symmetric loading or temperature distribution.

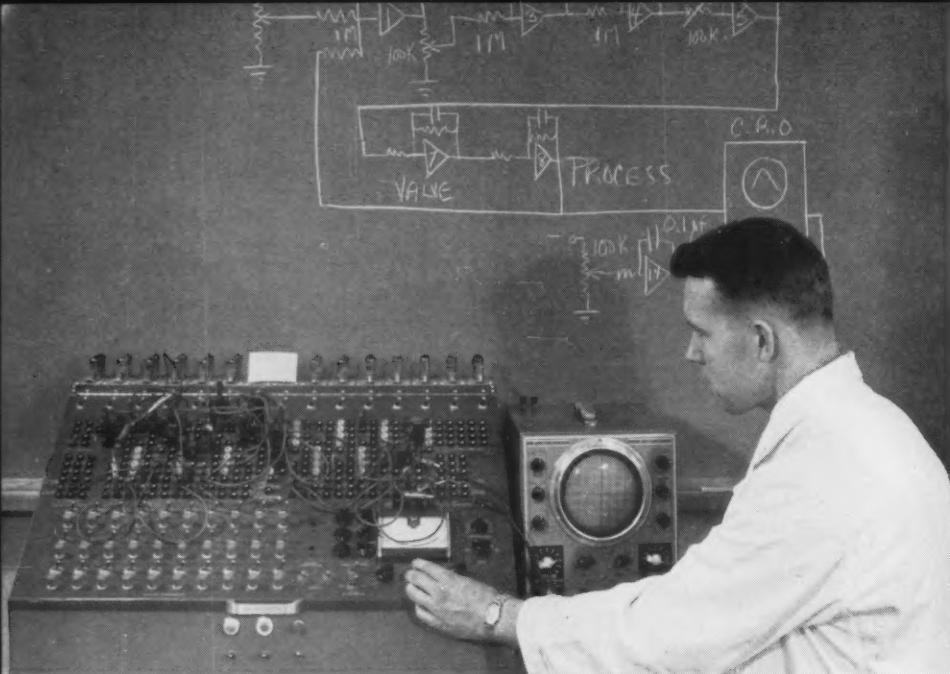
Plotted in the illustration are the bending moment

and hoop force near the constrained end of a long high-external-pressure bellows, as determined on this shell program.

For calculation purposes, the shell must have the form of a surface of revolution about some central axis, and the loading and temperature must be symmetrically disposed with regard to this axis. The shell must be sufficiently thin that conventional elastic thin-shell theory is applicable.

Following an engineering evaluation of the particular shell problem, sub-programs describing the geometry, loading and elastic properties of the shell must be prepared and the desired boundary conditions arranged. Stresses and deflections are printed as output at pre-selected positions along the shell.

Aside from its obvious applications to shell-analysis problems that are a part of more general engineering design or evalution problems, the new program can easily provide tables of solutions for special shell problems. It can also be modified for computers owned by or locally available to a client. ★



Ryerson student
at analog
computer which
simulates closed
loop process.

Not enough instrument engineers—why?

DE's editor, Doug Kaill, queries Canada's lack of qualified personnel at a time when the advance of industry is creating such exciting openings

Industry in Canada has been plagued for years by a serious shortage of qualified instrumentation personnel. This shortage is not a one-level affair, it exists right down the line. Design engineers to research and develop the instruments, applications engineers to select and apply the instruments, installation experts, and maintenance technicians to handle and care for the instruments are all in short supply.

The manager of one instrument manufacturing company told us only last month that it is impossible to hire a Canadian trained technician who can do a satisfactory job; this company has been compelled by conditions to hire only European trained personnel. The chief engineer of one of this country's largest process industries said "We are in the market for three instrument technicians to put on shift maintenance work — we just can't hire them anywhere".

We also remember quite vividly the problem faced some years ago by another of Canada's process industries at the start-up of a new plant, an event with which we were personally associated. Successful operation of the plant called for not less than twenty instrument technicians, of various grades and experience. When it was found impossible to locate men with the necessary qualifications, management took the only other alternative. They hired the best looking prospects and gave them a full training program in instrumentation. The training lasted approximately one year — and the fact that Dupont of Canada was able to start up their nylon intermediates plant on time and without incident vouches for the wisdom of the decision to train.

Instrument technology readily breaks down into two main branches. These can be loosely described as

process control and industrial electronics. The two are becoming more and more interrelated, as the process control field moves into areas calling for the application of electronics.

Educational programs, both at university and technical institute level, are also tending to overlap. Although no university in Canada has a course or offers a degree in instrumentation, they do make some attempt to cover the subject. Engineers working in the instrumentation field in Canada generally have received their basic education in one of the allied disciplines. These include electrical engineers, chemical engineers, mechanical engineers, maths and physics specialists and others.

The lack of instrumentation engineers has led to the development of instrument technology courses in some of the technical institutes of Quebec and Ontario. These help fill the gap between the untrained and the engineer. But there is still plenty of room for improvement with better facilities and courses. And, of course, there is the never-ending need for dedicated, qualified teachers.

On-the-job training

Most instrument specialists receive their training while they are employed. Some companies, as indicated earlier, resort to their own program of training. In fact, in many plants, the training of their instrumentation specialists is looked upon as a continuing item. Personnel are sponsored to all types of courses.

Correspondence courses are always available for those who have the will to undertake and follow through on them. One of the largest of the organiza-

tions offering correspondence courses recently added nine new courses to their electronics curriculum — "to keep pace with the rapid developments in the industry", their announcement read.

Perhaps one of the best means of obtaining training in a particular phase of instrumentation is to take one of the courses offered by the manufacturers of instruments and equipment. While it is true that the manufacturers own instruments are generally featured in such courses, adequate recognition is given to other makes. We have never heard of one of these courses being turned into a sales campaign, although some members of management have voiced such suspicion. The training is generally provided without charge, except that those attending are expected to pay their own travelling and living expenses. Typical of such courses are those conducted by the Bailey Meter Company in the process controls field and the International Business Machines in the electronics and computer fields.

Instrument technician training

The greatest need at the present time in Canada in the instrument field is for trained technicians. Technicians will be found wherever chemical plants, power plants, nuclear plants, pulp and paper plants, pipe lines, refineries and radio and television stations are located.

Although education is considered to be a provincial responsibility, authorities in Ottawa have recently entered the picture when it was announced that additional funds would be provided for the construction of technical schools. As an antidote for some of the unemployment it has been suggested that as many as possible be retrained in new trades. Among the suggested trades has been that of instrument technician.

Instrument technicians, like their senior partners, the instrument engineers, are usually the product of one of the basic courses, as electrical or radio and TV technology. Some of the more advanced schools, such as Ryerson Institute of Technology in Toronto, have courses specifically designed to produce instrument personnel, but these are the exception rather than the rule. Hence the plea from Canadian industry for more emphasis on this branch of science.

In its publication "Post-Secondary Technical Education" the Canadian Vocational Training Branch of the Department of Labour, Ottawa, has presented a good summary of the three types of course which could lead to a career in instrumentation.

Electrical technology

"An engineering technician trained in electrical technology will usually be involved in the production and distribution of electrical power or in the manufacture of electrical machinery and equipment, or in the controls for the machinery and equipment. He will have to know the principles and theory of electricity. He will need a good background in mathematics and applied physics, and he must be familiar with basic circuitry and theory as they apply to power systems and related control and protective devices."

Electronics technology

"Training in electronics includes considerable work in mathematics and science, the study of electron tubes, electronic circuits and theory, transistors, servomechanisms, television fundamentals, and related subjects. Some curricula in the area of electronics concentrate on industrial applications and may be designated as electronic technology, electronic and electrical technology, or industrial electronics."

Instrumentation technology

"... instrumentation is really the technology of measurement and automatic control.

"Often, he (the instrumentation technician) may be responsible for equipment that combines electronic, pneumatic, hydraulic, and perhaps optical features. This means that a well-trained technician in the field of instrumentation must have a broad theoretical background that includes physics, chemistry and mathematics, as well as the scientific technical aspects of instrumentation. He will find this training offered under curriculum designations such as instrumentation technology, or industrial instrumentation technology."

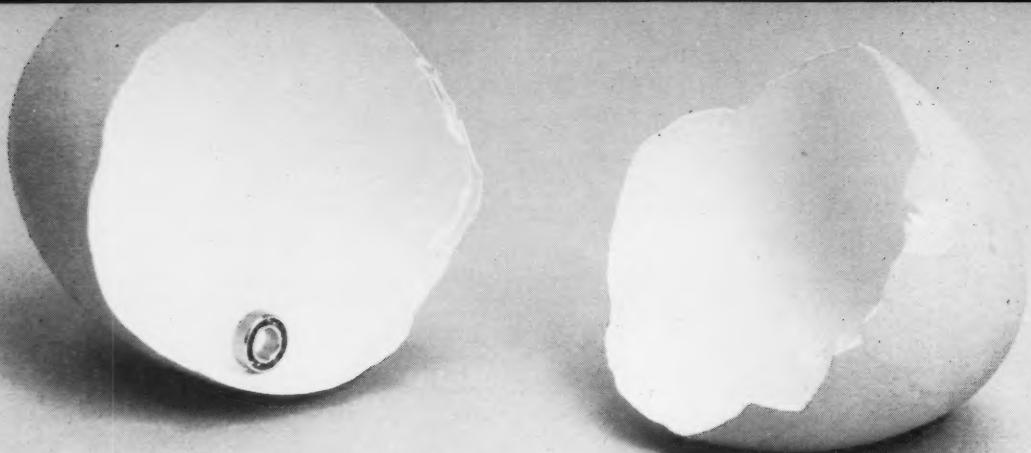
In addition to the publicly operated schools, there are a number of privately owned schools. Some of these offer courses leading to a certificate in instrumentation. The head of one of these schools told us recently that there is an over-demand for their graduates. They have a file of requests which they have not been able to meet, and it does not appear that they will be able to keep up to the demand for a long time to come.

Courses available

The following list gives some indication of the courses available in Canada on the general theme of instrumentation-automation. There is a certain amount of overlap in the three curricula. It must also be realized that changes are taking place almost daily in these programs, and contact should be made directly with the school of your choice for the latest information.

Name of institute	Elec-	Elec-	Instru-
	tronic	tronic	mentation
New Brunswick Technical Institute, Moncton	✓	✓	
Instituts de Technologie:			
d'Arvida	✓		
de Choutimi	✓	✓	
de Hull	✓	✓	
de Lauzon	✓	✓	
de Laval (Montreal)	✓		
de Montreal	✓	✓	
de Rimouski	✓	✓	
de Shawinigan	✓	✓	
de Sherbrooke	✓	✓	
de Trois-Rivieres	✓	✓	
Ryerson Institute of Technology, Toronto	✓	✓	✓
Eastern Ontario Institute of Technology, Ottawa	✓	✓	✓
Hamilton Institute of Technology, Hamilton	✓	✓	✓
Western Ontario Institute of Technology, Windsor	✓	✓	✓
Manitoba Technical Institute, Winnipeg	✓		
Saskatchewan Technical Institute, Moose Jaw	✓		
Provincial Institute of Technology and Art, Calgary	✓	✓	
Federal-Provincial Trades and Technical Institute, Burnaby, B.C.	✓		

Modern instrumentation can be a golden opportunity — a chance to a new life — a chance to forge ahead. There's a fantastic new world of electronics and automation opening up all around us, with unparalleled opportunities for thousands of instrument specialists. Industry is looking for the men (and women, too) who will take up the challenge and lead the way to a better way of life through the technology of instruments. ★

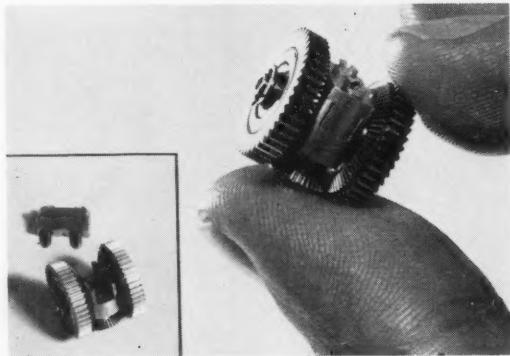


So tiny is this instrument bearing that over a hundred more like it could fit comfortably in the eggshell.
Circle 307 on Reader Service Card

(Miniature Precision Bearings)

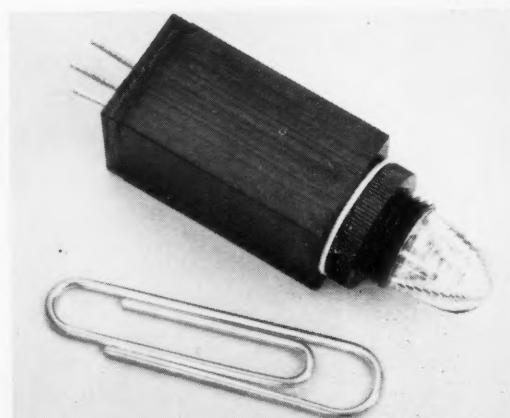
Designnews

in pictures



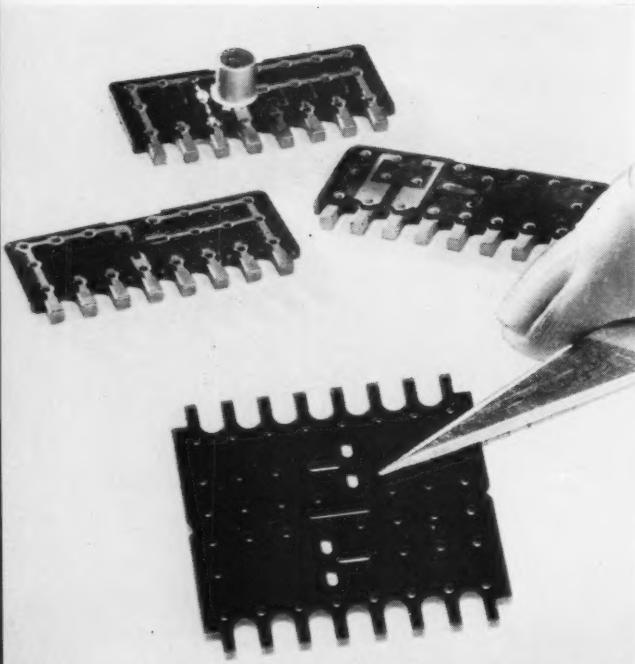
A unique clamp allows great reduction in the over-all length of hollow shaft differentials. The design employs a V-block clamp which provides positive locking with the shaft. (Empire Flight Components Inc.)

Circle 308 on Reader Service Card



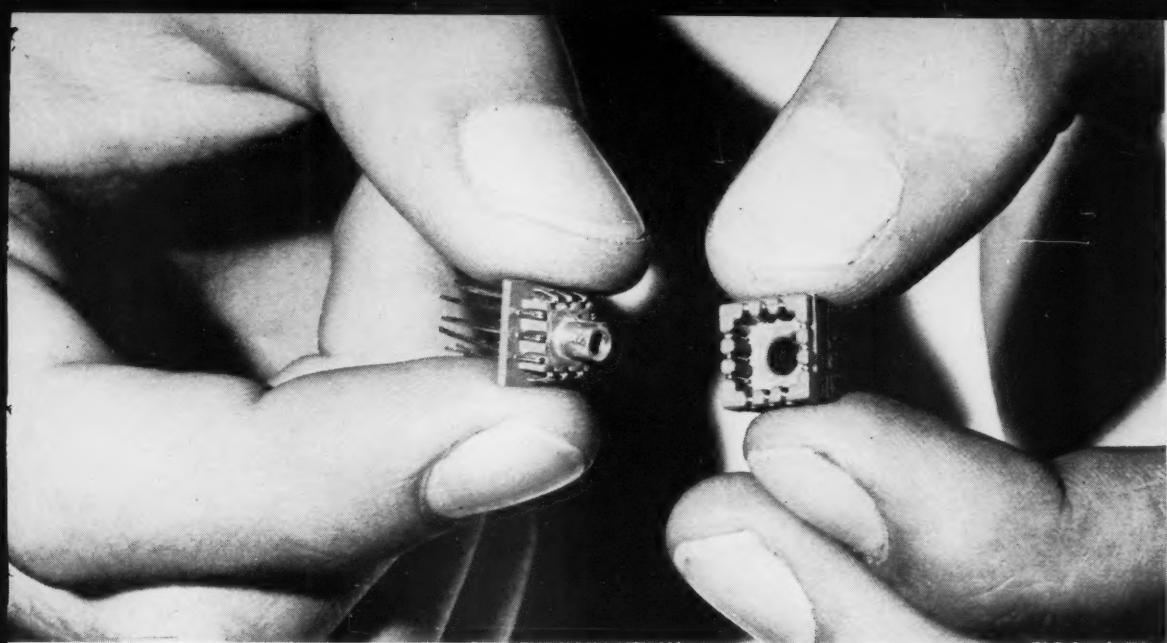
Tiny, low-power indicator light for portable, battery-operated or low voltage equipment. It generates its own firing voltage from any applied dc voltage of 4 volts or is switched from signals as low as minus 2 volts dc. (Telex Inc.)

Circle 310 on Reader Service Card



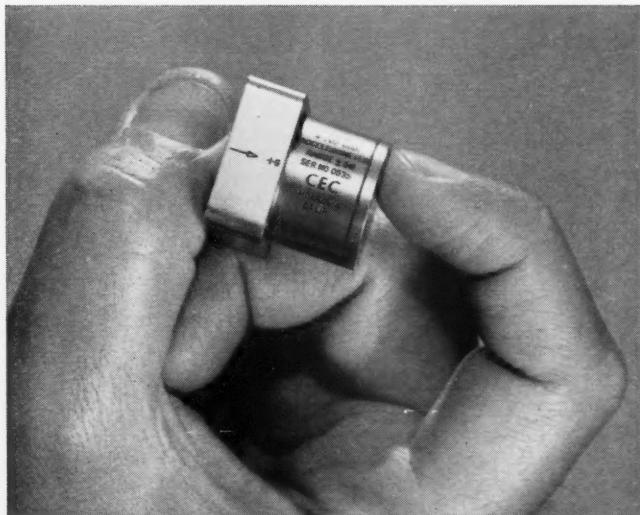
Complete operating circuits for thumb-sized micro-decks. Fotoceram wafers for the micro-decks are produced by a photosensitive chemical etching process to achieve the intricate patterns required. (Corning Glass Works.)

Circle 309 on Reader Service Card



New micro-miniature connector provides a means of interconnection and quick separation for "stick" or module packaged circuits. (Amphenol Canada Ltd.)

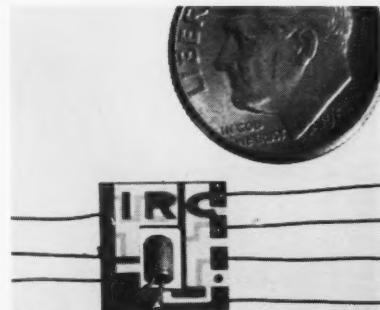
Circle 311 on Reader Service Card



Weighing less than three ounces, this temperature compensated gauge accelerometer is designed for measuring accelerations perpendicular to the mounting surface. (Consolidated Electrody namics Corp.)

Circle 313 on Reader Service Card

Instruments and controls for this modern age have been made possible only because designers have learned how to miniaturize . . . from bearings to power units . . . from spacistors to differentials



Representing a new technique in micro-circuitry, this tiny preassembled unit is particularly adaptable for adders, pre-amplifiers, binary counter and logic circuits. (Renfrew Electric Co. Ltd.)

Circle 312 on Reader Service Card



Pinhead shows relative size of tiny spacistor. A voltage is applied between base and collector in such a direction as to produce a high electric field and virtually no current. (Raytheon Mfg. Co.)

Circle 314 on Reader Service Card



*Operator at the computer input control console
of a solid-state computer-controlled 350 point alarm scanning system.*

Engineering design with computers

D. R. Best, B.A.Sc., industrial sales manager of Daystrom Ltd., describes the use of computers for reliable solution of design engineering problems

Automation has developed today to the point where a process may have not one, but a group of control loops, each loop operating with its own set point. In some applications various control loops are linked, but in the majority of cases the control loops operate independently. Each loop thus controls a process variable within predetermined limits, as selected by the operator. The operator is at a disadvantage because it is difficult to anticipate trends in the process with sufficient speed to enable corrective action to operate the plant with maximum efficiency.

An improvement in this type of control is the data logging system, various types being available to industry today. The data system supplies more information to the operator at a faster rate, but there is still considerable delay in the correlation and evaluation of the information supplied. It may still not be fast enough to provide control decisions before plant operation conditions are again changed.

A further refinement in the control loop is the use of a computer. A computer can be made to automatically supply the control decision, based on information fed into it by the operating instructions, combined with rapid measurement of the process variables.

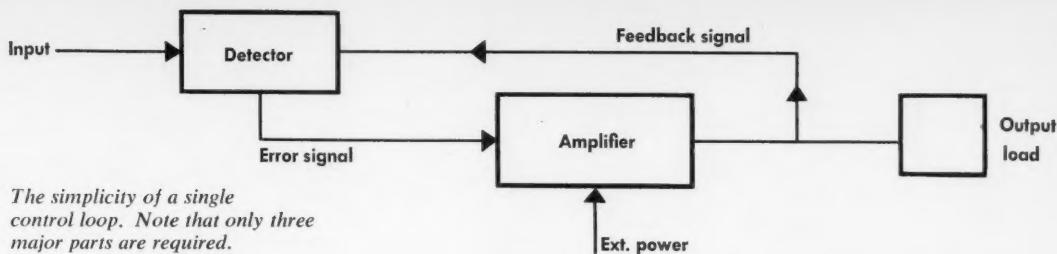
In the conventional control systems, control points

are set which may be periodically reset manually by an operator, based on changing operation conditions. A computer is used to measure these changes and then automatically calculate the changes required in the controls. The computer readjusts the controls faster and more accurately than can be done by an operator. This offers an increase in operating efficiency, reducing manufacturing costs. As the control system becomes increasingly larger and more complex, the computer becomes more economically favorable.

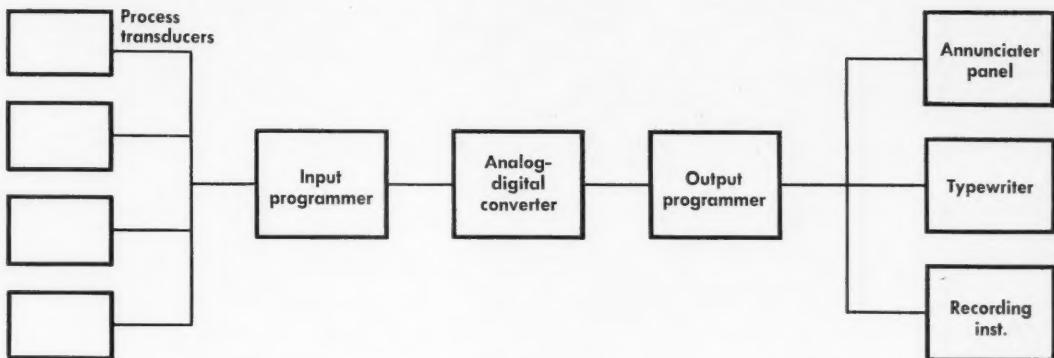
Reliability of major importance

In order to operate a computer control system it is obvious that the reliability of all systems components are of utmost importance. System control is required for continuous operation, hence it is not practical to shut down the process for maintenance. Considerable development work has been done by the industry to develop the hardware necessary to meet this requirement. Existing computer systems have been in operation with less than 1% down time. Solid state components have proved of major importance in improving reliability, eliminating tube failures.

A computer is a machine which performs physical operations that can be described by mathematical oper-



The simplicity of a single control loop. Note that only three major parts are required.



Arrangement of component parts in a typical digital computer for process control applications.

ations. Actually, the computer does not think. It must be fed the complete information on the job it is to perform. The control program must be laid out to cover the routine instructions for operation of the process. This information must include predetermined procedures for the computer in case of failure of the process equipment itself. If a condition occurs which cannot safely be handled by the computer, it must be designed to warn the operator that human assistance is needed.

In practice, the computer may scan a large number of control points and keep a record of this information. Should a condition occur where a process variable shifts from a predetermined value, the computer may call for resetting of associated controls and signal the operator an abnormal condition exists. In all cases the program information fed into the computer must be designed to protect the plant and personnel from damage.

Program factors to consider

When supplying instructions to a computer the following factors must be carefully considered:

- Since it is very expensive to supply more information than necessary to the computer, consideration must be given to the minimum information needed for efficient operation of the process, without additional first cost expense.
- With process control some relationships are linear; that is, a linear temperature change may produce a linear process effect. On the other hand, many variables act in a non-linear way. This makes the system more complex and must be allowed for in the computer instructions.

► The response time of each variable as it affects the system control is different, based on the inertia of each variable. Some variables may stabilize from a load shift in minutes, compared with others which may require a much longer time to reach a steady state condition.

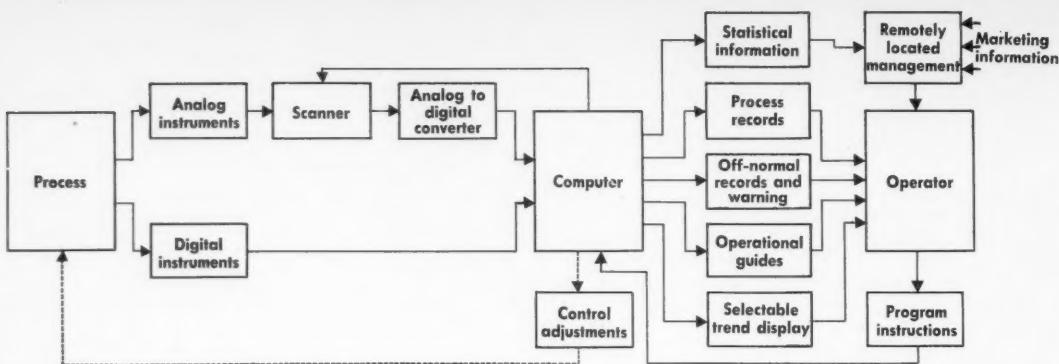
Analog versus digital

Computers for automatic control of industrial processes can be defined generally as either analog or digital.

The analog computer is derived from the procedure of setting up a model analogous to the process to be controlled. This can be a mechanical or electrical device simulating the function. Analog computers measure comparable values, as distinct from digital which work with hard figures.

The accuracy of the analog computer decreases as the number of computations performed on the signal increases. This computer, generally being a continuous device, is not suited to time sharing of the computer among a number of process variables, as required in the modern computer operated plant. The analog computer is ideally suited to solving relatively small problems, and it handles this type of problem with minimum cost.

By comparison, the digital computer is much more complex. It is considered by many to be too expensive to operate on the lesser type of problem. It has an almost unlimited programming flexibility, with the inherent advantages of digital accuracy. Digital computers may be likened to business machines, as they basically are high speed adding machines which operate



Conceptual block diagram of a typical operational information system. Arrangement is relatively complicated compared to units depicted on page 62.

with discrete steps, that is, they actually count. The fundamental digital computer operations are addition and subtraction.

Solid state computer

A typical solid state digital computer may be required to measure such variables as temperature, flow, kilowatts and bearing temperatures. Such variables require a wide variety of transducers to convert the information into electrical signals. These signals may be in the form of dc millivolts, dc millamps or pulse type digital signals. The computer continuously scans the transducers, which may number into the hundreds. A record may be required of the more critical points, in addition to printing "out of tolerance" points.

The standard digital computer may be described as consisting of four major elements. These are illustrated in the accompanying block diagram.

1. Process input section

Input signals are here supplied to the computer. These signals may be in the form of thermocouple inputs with cool end junction compensation. All analog input signals must be fed through the analog-to-digital converter, whereas transducers with digital outputs pass directly to the digital computer.

2. Digital section

A single analog-to-digital converter handles the various analog signals, converts this knowledge to digital form and transfers this value to the computer. The analog-digital converter integrates the analog input signal during the period it is connected to each transducer and therefore is insensitive to spikes that may be present on the signal lines.

We have stated previously that digital computers operate with time sharing of the computer by a large number of process variables. The system scans the variables on a time basis, with each point being measured and compared with the alarm set point stored in the computer memory. If the signal is abnormal, a trouble location annunciator and alarm printer may be activated. A signal can also be used to alert the operator of the abnormal condition. The alarm printer will

keep a record of the abnormal identification and the value of the scanned point.

What to look for

Desirable features of a flexible computer system are:

- A means of determining the accuracy of the system by use of a reference signal at the start of each scan cycle.
- Ability to alter set points internally as a function of some other measured variable.
- Automatic testing for open circuit conditions as each point is scanned.
- Ability to supply on demand, printing of any set and point identification.
- Means to render inoperative all pieces of equipment not required in the immediate service without affecting the system operation.

A computer receives its instructions from a program which is prepared externally, read into, and stored into the memory section. After a program has been stored, the system operates automatically, reading each program step from its memory without further instruction.

Computers are designed to work with various output devices, such as electric typewriters, paper tape punches, digital recorders and digital display devices. The computer may also be used to directly control actuators, valves, etc.

The complete role that computer control systems will play in industry has not yet been established. Engineering surveys required to obtain the process dynamics have in some cases proven very expensive, in addition to the capital cost of the computer. One can generally conclude that modern manufacturing plants will have more and more instruments suitable for incorporating into a computer system. To justify a computer installation we require an application where the efficiency of the process will be improved.

Management has to make the decision to proceed with the extensive investigation required for consideration of a computer controlled process, in order to benefit from the gains which may be available from such an installation.



Designing for motor lubrication

Read what a panel of experts has to say on extending instrument motor life

Motor life has always been a problem of major magnitude. Design engineers have tried many and varied methods of extending motor life. The problem is particularly aggravated when one considers the modern instrument motor. Here is a piece of equipment that has been miniaturized to the *n*th degree — yet is still expected to operate without interruption for upwards of ten years, and with a minimum of servicing.

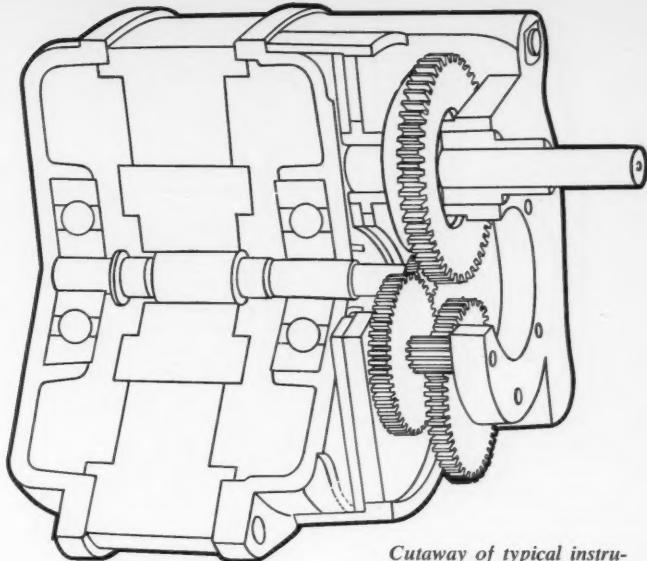
Lubrication is perhaps the key to the whole problem. Usually it is the bearing that fails. When such failures occur (and they are more common than we care to admit) the cause is generally faulty lubrication. Not necessarily insufficient lubrication, for quite often an extra drop of oil has been the culprit.

Designing for adequate lubrication, then, is still one of the prime factors to be considered in the overall design of instrument motors. A recent instrument motor symposium held during an ISA show in New York City discussed the subject at some length. Here are excerpts from some of the comments given at that time.

What are the requirements?

Reviewing all the problems, complaints and discussions which we have had with instrument engineers in the past ten years I believe that the production and design engineers in the instrument field will be satisfied with a motor which will run for ten years without attention, have a response voltage of 1%, and a selling price of \$5. Let us examine the problems of extending motor life to a reliable 5 to 10 years.

There are two basic motor applications involved, the synchronous motor used for chart drive and the servo motor used for the pen drive. The chart drive motor is normally a continuously running motor while the servo motor may stay in null position a large percentage of the time. During the period the motor



Cutaway of typical instrument motor . . . ball bearings on motor shaft . . . sleeve bearings on output shaft

is at null, the rotor is oscillating or dithering continuously due to the fact that the reference winding is energized from the 60 cycle line and the control winding is supplied with a d-c from the instrument amplifier. This dithering causes fretting corrosion of bearings and gears due to the fact that the very small movement of the rotor squeezes out the lubricant from between parts and it is not replaced as would be the case in normal running conditions. Here we need a lubricant which will stay in place regardless of lack of film-building rotation.

Both the chart and pen drive motors have a common requirement. These motors are normally placed in totally enclosed, non-ventilated cabinets along with other heat producing items so that the motor ambient is always 15 to 35 degrees C above room ambient. In many applications this means motor ambient is 60 C. Taking into consideration the temperature rise of the motor and the wide variety of installations, from furnace room to unattended automatic stations, we arrive at a lubricant temperature range of - 40 C to 105 C. This top temperature may be increased as miniaturization continues. Insulation materials are available for higher temperatures and are practical and economical up to Class F which allows winding temperatures of 155C.

Another important requirement of the lubricant is shelf life. Due to lapse of time for manufacture of bearings to actual installation of recorder, shelf life must be a minimum of one year. While shelf life of one year is regarded as adequate for normal production, a much longer period is desirable to minimize inventory problems of both bearings and motors.

Both chart drive and pen drive motors are normally used with several stages of gearing. In many cases the gear unit is an integral part of the motor assembly, and all conditions previously mentioned also apply

to gear lubricants. While the motors are furnished with either ball or sleeve bearings, the gear units are normally furnished with sleeve bearings. Porous types are favored over those made from solid material. The continuously running gear case presents a common type of lubrication problem while the gear case used with a servo (dithering) motor requires special attention due to impact loading of the first and second stages of gearing. Here again we need a lubricant with the staying qualities of glue, yet it must be smooth and quiet operating.

We must consider the desirable qualities of the lubricant from a servo motor aspect if we are to obtain acceptable response voltages. The response voltage of a servo motor as a percentage of rated voltage must be kept to a low value to keep the dead band of the instrument as small as possible. At low input, the motor torques are so low that response is seriously affected by sticky or lumpy grease. Here a grease which might give excellent life in a continuously running motor would fail in a servo motor due to a tendency to stiffen up slightly or become lumpy when not being worked. At present, oil lubrication or a full channeling grease is felt to be best for ball bearings where smooth uniform response is required. Many applications require that response voltage shall not exceed a certain value, say 5% of rated voltage, and if motor voltage varies from 1% to 5%, performance is acceptable. A few applications require that the response voltage of a given motor shall be less than a specified value and starting voltage of each motor must not vary more than 4 to 5%. This means torque due to the lubricant must be very low and very uniform.

Maximum life with oil

Laboratory tests have shown that maximum bearing life is achieved when the bearing is lubricated periodically with oil. While squirting oil down through a hole in the motor bearing is possible in the laboratory, it is impracticable for installed instrument motors. The development of completely self-enclosed ball bearings with contact seals on both sides has created the problem of developing a grease which will have a useful life in excess of the normal fatigue life of the bearing under a great variety of operating conditions. At present, the life of a bearing which depends solely on its original grease for its lubrication is, for lightly loaded bearings, the oxidation life of the grease. This in turn is dependent upon the temperatures of the grease at work on the ball, race and separator surfaces. The principle factors affecting operating grease temperatures are:

- heat gain from parts adjacent to the bearings
- heat due to grease internal friction
- heat due to rolling friction
- heat loss by conduction, radiation and convection.

It has been found that a given rise in bearing operating temperature affects grease life least if it is caused by heat developing outside the bearing and most when caused by heat from bearing friction.

Sleeve bearings are popular

Powder metal sleeve bearings are always somewhat porous, and advantage of this feature is taken by filling the pores with oil. The trend in the recent past has been toward high strength, which is generally unnecessary, and high density, which means low porosity and low oil content. The current trend is to make a standard, a high-density, and a low-density material with densi-

ties of 6.4 to 6.8, 6.8 to 7.2, and 5.8 to 6.2 gm per cc respectively.

When most of the oil supply is contained in a reservoir, the choice between densities is not critical. The high density material, because of its low porosity, has a certain effect of metering out the oil supply, and prolonging its life. When there is no reservoir and the only oil supply is that in the bearing, then the low density bearing, due to its greater oil capacity, is preferred. To make the most of this, the porosity can be very thoroughly filled by vacuum impregnation. This is found to increase load capacity by 40 to 50%, which corresponds to an increase of about 400% in life at a given load.

A sintered bronze containing 3% lead (Type I, Composition B, or SAE 843) does even better; at a given speed, in tests up to 40 hours long, it has shown double the load capacity of 90-10 sintered bronze, with mechanical properties roughly 2/3 as great. This means a very great increase in life. Once more, it's a case of usually having strength to spare in the 90-10 material. This excess strength can be traded for improved bearing performance or longer life.

Powder metal bearings can be lubricated with oil or grease. Unless grease liquifies, it must be fed directly to the bearing surfaces. Oil is preferred because when it is fed to any part of the bearing, it will distribute itself throughout by capillary action, and will automatically reach the bearing surfaces. Three decades of successful experience have shown the value of this feature.

Lubrication requires compromise

Lubrication of any device is a matter of compromise. At present there is no lubricant that will do all jobs equally well. Consequently, it is necessary to choose the particular lubricant that will be best suited to the mechanism and its environment. The most important conditions to be considered are: normal operating temperature range, short term temperature extremes, types of bearing, bearing size, speed, load, reversibility and materials with which the lubricant may come into contact.

Regarding the use of a synthetic lubricant versus a petroleum based one, there is no general rule for selection. There are broad overlapping areas in which either will do a satisfactory job. However, there are limitations. Petroleum lubricants are generally not suitable above 300°F for extended periods of operation. Petroleum lubricants for extreme low temperatures are available but these are not suitable above 150°F because of their high evaporation rate. Therefore synthetics have their greatest applicability where the operating temperature range is very wide or very high.

Under boundary lubrication conditions, where a full fluid film does not exist, petroleum lubricants are generally better.

A realistic specification on operating temperature range is extremely important. A wide specification "just to be on the safe side" does more harm than good since a lubricant capable of much better performance within a narrower range is possible.

The major deteriorating chemical change in both oils and greases is oxidation. The rate of oxidation is approximately double for each 10°C increase in temperature. Every means should be explored to keep as much of the lubricant as possible at a low temperature. This is difficult in an instrument motor where circulating lubrication is out of the question. This is, however, a design area that needs to be explored. ★

New controls for automation in the home

The latest in controls for boosting everyday performance of domestic appliances is outlined by Don Weekes, staff technician at Robertshaw-Fulton Controls

New developments are constantly taking place in all branches of the control field. This applies not only to the exotic and sophisticated electronic, hydraulic and pneumatic systems as used in industry, but to other items which are much closer to home.

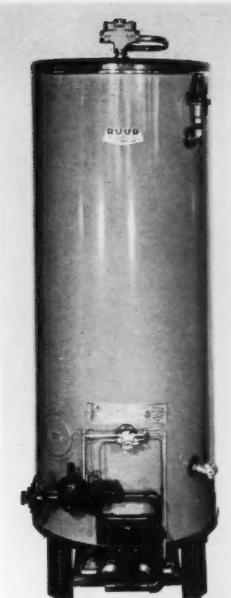
Automation is now an accepted fact in practically all our homes. Wherever power is available (electrical or gas) we put it to work to reduce our workload. We have automatic toasters, automatic washers and dryers, automatic control of hot water, automatic cooking facilities.

This article is devoted to explaining the application and operation of some of the modern temperature controls which have recently been introduced to the domestic appliance field. These units were designed to improve the everyday performance of appliances. They could possibly have application to some of the products which your company designs and manufactures.

Safety pilot for gas ovens

Latest idea in this field is an entirely new type powered by a vapor pressure thermal system. Two-stage blue flame pilot eliminates the need for other devices. The 100 btu standby mini-pilot assures a cool oven and the 300 btu burner pilot, which operates only when the burner is used, guarantees positive ignition.

When the oven is turned on gas flows to the 300 btu burner pilot, which is then ignited by the 100 btu standby mini-pilot. The burner pilot flame vaporizes the heat-sensitive fluid in the stainless steel bulb. The transmitted vapor pressure causes immediate movement of the diaphragm. This movement is multiplied by a system of levers, exerting force against the spring which holds the silicone rubber valve disc against the seat. This action opens the valve, and gas flows to the oven burner.



Gas water heater uses sensing rod for selective temperature control.

When the pilot gas is turned off, the thermal element cools and within seconds shuts off the gas supply to the burner.

Low temperature control

By the additional use of another new control, the conventional gas oven can be used as a warming oven at temperatures as low as 140 degrees.

At temperatures above 325, the oven thermostat operates in the normal way. Below 325 though, operation is somewhat different. At these lower temperatures, if the by-pass flame tends to override the temperature setting, the oven burner shuts off completely. If the temperature drops to a point where more heat is required, the oven automatically relights.

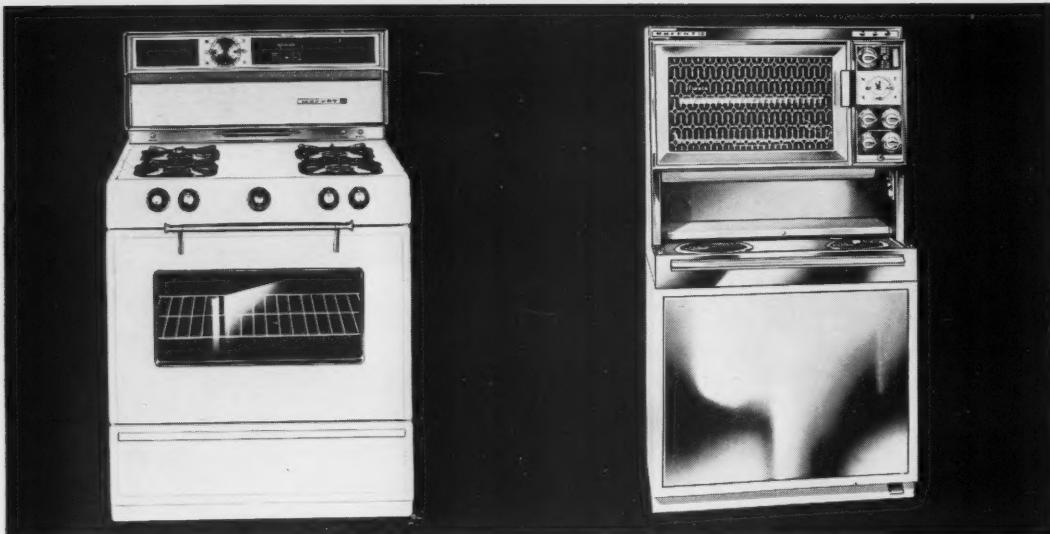
To accomplish this on-off cycling which is necessary for low temperature control, the oven control shuts off the gas to the burner pilot. This in turn shuts off the gas flow to the burner. When the oven temperature drops below the set point, the control again operates and gas flows to the burner pilot.

Top burner control

The "burner with a brain"** is the latest word in top burner control. It is a combination gas cock and thermostat which provides automatic temperature control. This thermostat is designed to permit manual adjustment of the flame as well as temperature setting, by the use of one dial.

An hydraulic sensing element is maintained in contact with the bottom of the utensil on the burner. The fluid in the sensing element expands when heated and the resulting expansion is transmitted through capillary tubing to move a stainless steel diaphragm in the

*American Gas Association slogan.



Automatic valve gives 100% shut-off if pilot flame is extinguished.

Feature is single oven switch giving off, preheat, bake and broil.

thermostat. The movement of the diaphragm regulates the gas flow, allowing just enough to maintain the desired temperature.

Hot water control

Keeping up the supply of hot water is one of the problems faced in many a home in Canada. Gas is known as one of the quickest heating media for this purpose. Controlling the temperature can now be accomplished with one compact unit, which contains a thermostat, automatic pilot, adjustable main gas pressure regulator, pilot filter and main and pilot gas cock.

The adjustment dial which controls the built-in pressure regulator setting is located on the front. Rotation of the dial actuates an adjustment screw. This increases or decreases the spring pressure setting, resulting in corresponding gas pressure changes to the main burner orifice, thereby varying the input rate to conform to the hot water demand.

This means that the hot water recovery can be set at, for instance, 30 to 50 gallons per hour simply by turning the dial. All other adjustments are taken care of by the unit.

Clothes dryer control

Older clothes dryer control systems depend on time only, or a combination of time and temperature. Thus it is up to the operator to compensate for humidity and ambient temperature variations. This she does mainly by guesswork.

A new control works on entirely different principles. It automatically determines the evaporation taking place by measuring the temperature drop of the air passing through the wet clothes — and then calculates with extreme accuracy the amount of drying required for the size of load, and the fabric. Temperature is gradually reduced as the clothes approach the desired dryness. When the set dryness is reached, heat is turned off for gentle cooling.

The new system has no timer. This overcomes the

problems of ambient temperature and humidity, which cause overdrying, underdrying and time guesswork.

Electric oven controls

A single dial operation that provides multiple control is the aim of most domestic appliance controls. This is certainly the case with electric oven controls. The cook wants to be able to broil, bake, or operate the rotisserie with, of course, full temperature control — all from one dial.

Here's the data on the latest in such controls. It provides a variable bake zone from 140 to 500°F with automatic preheating feature, and a separate broil zone between 375 and 530°F. When the dial is set in the bake zone over 300°F, both bake and broil elements come on automatically, to provide quick heating of the oven. When the oven is heated, the broil element disconnects and the bake element cycles, maintaining the selected temperature.

When the dial is turned to the broil zone, the bake element is disconnected and only the broil element is energized, with the temperatures controlled by the thermostat.

Wall thermostat

A new concept in low voltage switches is incorporated into the most recent such unit. It is hermetically sealed in a glass bottle, and is actuated by a magnet brought into proximity of the contacts.

Its simplicity and minimum of moving parts makes it an excellent design and it has proven to be very reliable. It needs no leveling.

These then, are some of the recent innovations in the field of temperature control for domestic appliances. There is an ever ending race for improvement. New ideas are continually being researched. New techniques are regularly developed. The problem of keeping ahead of the demand forces instrument engineers and designers to investigate every suggestion or proposal for an improvement in their product. The ultimate has not yet even been approached. ★



Find the one drafting room need not supplied by Bruning!

It's the man at the board. Bruning furnishes everything else for the drafting room and architects as well as field equipment for the engineer. Only a few of hundreds of items are shown. Bruning Copyflex machines are backed by a full line of materials for making clear precise copies—Bruning also supplies over 100 varieties of sensitized papers, cloths and films as well as non-sensitized translucent tracing and writing paper, cloths and films.

Whether the order is large or small Bruning promptly answers your needs with top-quality service and supplies based on years of experience.



CHARLES BRUNING COMPANY (CANADA) LTD.

37 Advance Road Toronto 18, Ontario

For further information mark No. 113 on Readers' Service Card

FAFNIR BEARING NEWS

BEARINGS THAT MAY SOLVE PROBLEMS FOR YOU — PRESENTED BY YOUR FAFNIR DISTRIBUTOR

FOR HEAVY DUTY APPLICATIONS



... we recommend CO type heavy series cylindrical cartridges. They are available in shaft diameter sizes from $\frac{3}{4}$ " to $3\frac{1}{16}$ ". NO. 61101.

FOR LIGHT DUTY APPLICATIONS

... this PB type pillow block gives the advantages of anti-friction bearings at low cost. Available in shaft diameter sizes from $\frac{1}{2}$ " to $1\frac{1}{4}$ ". NO. 61102.

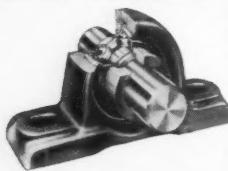


SPACE LIMITATIONS?



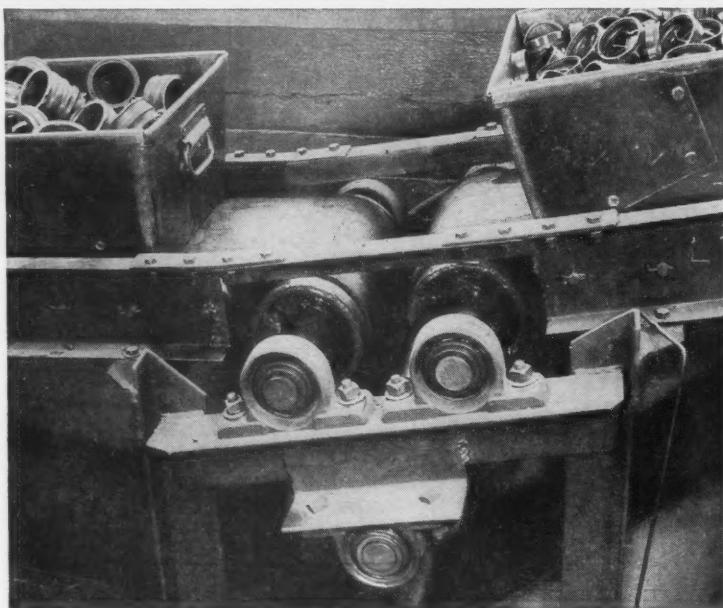
Fafnir Flangette stampings are designed for use where space is a factor. Where it is necessary to cut off one or more sides of the standard flangette stamping, the Triangular Flangette is used. NO. 61103.

SHUTS OUT DIRT — This RAK type bearing incorporates Fafnir's Wide Inner Ring Bearings with contact type Plya-Seals which shut out dirt even at very slow speeds. Available in all popular shaft sizes from $\frac{1}{2}$ " to $2\frac{1}{16}$ ". NO. 61104.



WATER COOLED BEARING BEATS THE HEAT

Fafnir SAL type (standard) and SAOL type (heavy series) ball bearing power transmission units, utilizing water-cooled end covers, have been successfully used in close proximity to ovens, fans, etc., with inside temperatures as high as $1,500^{\circ}\text{F}$. A small amount of water flowing through a $\frac{1}{8}$ in. copper tube keeps the bearing lubricant cool, thus avoiding a breakdown of the oil. NO. 61105.

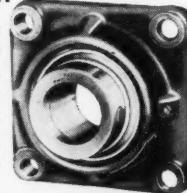


8 YEARS WITHOUT TROUBLE

Fafnir Bearing Quality Selected For This Hard-working Conveyor System

Eight years of operation with no maintenance service except occasional lubrication ... that is the record of the Fafnir Ball Bearing units installed on the conveyor shown above.

The complete bearing installation on the 3-pulley snubbing device of the conveyor includes six Fafnir LAK Type Pillow Blocks. Four of the blocks are mounted right side up and two, upside down. The conveyor transfers heavily loaded work boxes from one plant floor to another. Like all precision-built Fafnir Industrial Units, LAK Type Pillow Blocks have the famous Fafnir Wide Inner Ring Bearings with self-locking collar ... easiest of all to install. NO. 61106.



COMPENSATES FOR SHAFT MISALIGNMENT

This LCJ type flange cartridge incorporates Wide Inner Ring Bearing which compensates for shaft misalignment.

Normally used where a shaft meets a flat surface at right angles. Shaft sizes from $\frac{1}{2}$ " to $2\frac{1}{16}$ ". NO. 61107.

60-110R

United Steel
CORPORATION LIMITED
(FAFNIR BEARING DIVISION)
58 PELHAM AVE., TORONTO 9

For further information mark No. 172 on Readers' Service Card

NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY OR TOWN _____ PROV. _____

—WANT MORE DETAILS?—

Send me literature and prices on:

- NO. 61101 NO. 61103 NO. 61105
 NO. 61102 NO. 61104 NO. 61106
 NO. 61107

New CSA Standards

The following new standards have recently been published. They are available through the Canadian Standards Association, 235 Montreal Road, Ottawa 2, Ontario.

B71.5-1960—Tubular Rivets

This first edition covers the dimensions and requirements of standard tubular and semi-tubular rivets, having oval, truss, and flat countersunk heads in a range of sizes from 1/16 to 5/15 inches diameter. Standard materials, finishes, heads, lengths, head forms, and other such requirements are given. Suggested clinch allowances, which are useful for determining suitable rivet lengths, are given in an Appendix for reference purposes.

Price \$1.50

C105-1960 — Indoor High Potential Full-Load Air Interrupter Switches

This first edition covers high-potential full-load air interrupter switches—indoors or within outdoor enclosures subject to usual service conditions—at potentials ranging from 751 to 15,000 volts a-c inclusive. It applies to interrupter switches for operation at their standard ratings where: the altitude does not exceed 3,300 feet—the temperature of the air surrounding the switches and their enclosures, if any, is not lower than -40C nor higher than 40C.

Price \$1.75

C22.2 No. 78-1960 — Varnished Cloth Insulated Wires and Cables

This third edition of No. 78 of a series of Standards issued under the Canadian Electrical Code Part 11 supersedes the second edition published in 1956. It covers single and multiple-conductor wires and cables in sizes from No. 14 AWG to 2,000,000 circular mils having an insulation of varnished-cloth tapes, which are recognized for use at 5,000 volts or less, and at a maximum operating temperature of 85C (185F).

Price \$2.50

C22.2 No. 124-1960 — Mineral-Insulated Copper-Sheathed Cables

This is the first edition of No. 124 of a series of standards issued under Part 11 of the Canadian Electrical Code and applies to mineral-insulated copper-sheathed cables. In addition, this Standard also covers sleeving which is intended for use as insulation for the copper conductors at the end of terminations of Type MI Cable.

Price \$1.50

Technical literature

Cable pressure guard—Brochure specifying contactor which warns of imminent breaks or leaks in telephone cables. United Electric Controls (Canada) Ltd.

Circle 315 on Reader Service Card

Positive displacement meter—Bulletin on fast-flow rotary meter for petroleum products of any viscosity. Canadian Meter Company Ltd.

Circle 316 on Reader Service Card

Analog computer—5-page bulletin describing compact, flexible unit for industrial and educational purposes. Bepco Canada Limited.

Circle 317 on Reader Service Card

Small temperature recorder—Bulletin on pocket-sized temperature recorder suitable for either cooking vessels or insulated trucks. R. H. Nichols Ltd.

Circle 318 on Reader Service Card

DC potentiometer—Specifications bulletin on null-balance potentiometer receiving input signal from 200 to 1,200 millivolts. Fischer & Porter Co.

Circle 319 on Reader Service Card

Moisture control—Bulletin on automatic system for controlling moisture with minimum of monitoring. The Foxboro Company.

Circle 320 on Reader Service Card

Eddy current testing—Brochure on non-destructive testing machine for detecting internal or surface flaws and cracks. The Budd Company.

Circle 321 on Reader Service Card

Switch selection catalogue—48-page book on selection of switches of all kinds. Keyes, Martin & Company.

Circle 322 on Reader Service Card

Instrument precision bearings—Catalogue with 40 pages covering dimensional data and application of miniature precision ball bearings. United Steel Corporation Limited.

Circle 323 on Reader Service Card

Electronics ventilation—48-page catalogue of fans and blowers for cooling and ventilating electronic equipment. McLean Engineering Laboratories.

Circle 324 on Reader Service Card

Low pressure regulator—Bulletin on new low pressure regulator for batch ovens, furnaces, etc., as well as for domestic appliances. Canadian Meter Company Ltd.

Circle 325 on Reader Service Card

Severe service materials—Pamphlet "Materials for Advanced Technology" with data on 12 new materials for applications requiring resistance to abrasion, chemicals, corrosion, nuclear radiation and high temperatures. The Carborundum Company.

Circle 326 on Reader Service Card

Hose assembly bulletin—Bulletin providing a reference for various categories of end fittings for low or high pressure hose assemblies. Aeroquip Corporation.

Circle 327 on Reader Service Card

Welded diaphragm bellows—8-page brochure with design and application data to adapt bellows to modern needs. Metal Bellows Corp.

Circle 328 on Reader Service Card

Uses for silicones—Booklet with most advanced information on new applications of silicones to aid design engineers and product development managers. Union Carbide Corporation.

Circle 329 on Reader Service Card

Catalogue of clamps and vises—24-page catalogue describing complete line of machine vises, rotary tables and other work-holding and positioning devices. Universal Vise & Tool Company.

Circle 330 on Reader Service Card

Blind rivet selection—Brochure with data on rivet selection and a procedure chart. Cherry Blind Rivets.

Circle 331 on Reader Service Card

Machining laminated plastics—Technical article describing specific methods for standard laminates and for recently introduced grades. National Vulcanized Fibre Co.

Circle 332 on Reader Service Card

Production parts manual—Manual with specifications of adapter couplings, bushings, elbows, tees, hose assemblies and brackets. Lincoln Engineering Company.

Circle 333 on Reader Service Card

Tool components and applications—24-page booklet to give designer a clearer concept of standardized tool components and their various applications. PIC Design Corp.

Circle 334 on Reader Service Card

Thread insert for plastics—Bulletin on a push-type insert for forming strong threads in plastics after molding. Helicoil Corporation.

Circle 335 on Reader Service Card

Self-locking fasteners—64-page design manual on small, light-weight types of self-locking fasteners for electronic-avionic applications. Elastic Stop Nut Corporation of America.

Circle 336 on Reader Service Card

Instrument catalogue—Illustrated catalogue of instruments for dielectric strength, insulation resistance, ground resistivity and allied test applications. Associated Research, Inc.

Circle 337 on Reader Service Card

Internal inspection—Booklet on introsopes with data on their use. Foster Instrument Co. Ltd.

Circle 338 on Reader Service Card

(Continued on page 72)

PLASTICS

Plastics have many advantages for countless components used in manufacturing today. At Smith & Stone we offer complete services for consultation, designing, engineering, tooling, moulding and finishing. Full facilities are available for compression moulding, injection moulding and extrusion. Let us show you what plastics can do for you.



For further information mark No. 160

Technical literature *continued*

Turbine instruments — 12-page bulletin describing application of turbine supervisory instruments. Canadian General Electric Co. Ltd.

Circle 339 on Reader Service Card

Computer technology — Illustrated 20-page brochure detailing latest advances in computer equipment and technology. Computer Systems Inc.

Circle 340 on Reader Service Card

Induction heating — Publication reviewing applications, research and production relating to induction heating. Lepel High Frequency Laboratories, Inc.

Circle 341 on Reader Service Card

Paper tension control — Bulletin describing operation of tension head and potentiometric recorder controller at various sections of a paper machine. Canadian General Electric Co. Ltd.

Circle 342 on Reader Service Card

Polypropylene tubing — Engineering report on a new tubing claimed to have 30 to 50 times the life of nylon at elevated temperatures, giving applications, ordering instructions, etc. Imperial Brass Manufacturing Co. (Canada) Ltd.

Circle 343 on Reader Service Card

Clutch catalogue — Illustrated catalogue of a complete line of standard, custom and advance design lever action clutches. V-Belt Clutch Company.

Circle 344 on Reader Service Card

Spring-tension fastening — Brochure summarizing classes of spring-tension fasteners. Associated Spring Corp.

Circle 345 on Reader Service Card

Packaged hydraulic systems — Bulletin showing how these systems can solve a range of process control problems in chemical, food, steel and other industries. Vickers-Sperry of Canada Ltd.

Circle 346 on Reader Service Card

Industrial motor control — Catalog of starters, relays and other control devices, with hints on proper selection, dimension tables, etc. Klockner-Moeller Canada Ltd.

Circle 347 on Reader Service Card

Thermostat metal calculators — Kit for plotting sample sizes of thermostatic bimetal for simple beams, cantilever beams, U-shapes, etc. Texas Instruments Inc.

Circle 348 on Reader Service Card

Zinc alloy diecasting — New third edition of a booklet on casting with zinc base alloys, with a section showing how improper casting techniques affect the part. Henning Bros. & Smith Inc.

Circle 349 on Reader Service Card

DUNCO all new REED RELAY

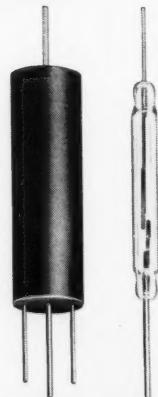
Pictured are two of the new DUNCO reed relays.

REED relays consist of one or more dry reed glass enclosed switch capsules surrounded by a direct current magnetizing coil to provide electromagnetic relay action.

GOLD contacts, 15 watt 1 amp resistive load rating, operating in an inert gas sealed in glass provide long life contacts completely unaffected by atmospheric contamination.

REED relays are ideally suited to low level and light load switching for hundreds of millions of operations.

REED relay contacts are fast operating; a single cycle being completed in less than 1 millisecond.



Single-Pole
No-Contact
with
Encapsulated
Coil

Basic
Dry Reed
Switch

Ask for Bulletin RR-1



STRUTHERS-DUNN RELAYS

Division of RENFREW ELECTRIC CO., LIMITED

349 CARLAW AVENUE • TORONTO 8, ONTARIO

For further information mark No. 165 on Readers' Service Card

Briefs

Controls: World's largest moving coil meter (about 17 feet square) overlooked Electrical Engineers' Exhibition at Earl's Court last month; total electrical load connected during exhibition was indicated by 5-foot aluminum pointer moving over 20 feet of meter scale, easily readable from 100 yards . . . Controls Company of America has expanded manufacturing and selling of controls in Argentina with acquisition of Controlec . . . Go/no go gauge that signals audibly or visibly when width of a moving web falls outside preset tolerances has been developed for fabric, paper or plastic film inspection by Matrix Controls Company . . .

Those computers . . . "Computers are now being used to roll steel." Not quite, but Canadian General Electric is feeding cards into a computer at Peterborough to simulate actual engineering techniques. Apparatus department engineer W. G. Wright says technique changes and product development can be proved in this way before costly floor space, time and materials are involved in the plant. . . .

Testing talk: More than 1200 engineers and scientists, working in no less than 360 committee sessions produced some real results in developing and revising material standards during Committee Week of American Society for Testing Materials at Cincinnati. Some subjects were: use of malleable iron at high temperatures, new exposure program for coated wire, electroplating definitions, classification of fire bricks . . .

Up in the air: Two special kinds of glass are being manufactured for solar cell covers on space vehicles; their role is to guard against high temperatures, thermal shock and micrometeorites, yet efficiently transmit wavelengths utilized by the cells . . . a new medium-to-high range pressure transducer is the most accurate ever built for airborne use; it utilizes the unbonded strain gage principle with four-active-arm spring type sensing element and diaphragm force summing area . . . U. S. Army Missile Command has achieved the successful static firing of an improved high-energy solid propellant rocket motor using lightweight, high strength motor case of titanium . . . since plastic was once considered very sensitive to heat it seemed hardly the thing for rocketry, but scientists have exposed a plastic missile nose cone to temperatures up to 20,000 F and recovered it intact . . .

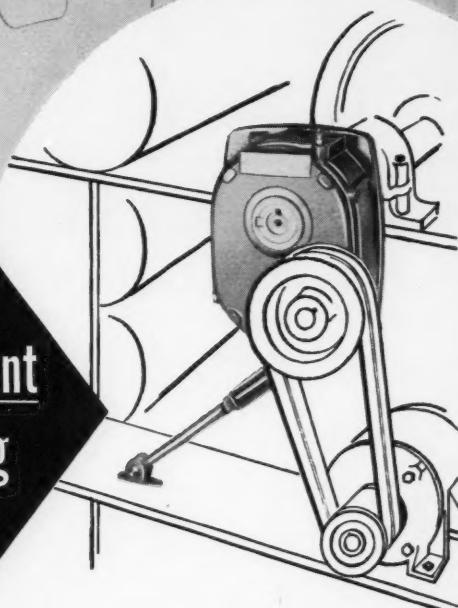
(Continued on page 75)

Specialists in Power Transmission 100 years of service to industry

DAVID BROWN
FOOTE BROS.



No Alignment or Coupling Problems



Each DAVID BROWN & FOOTE GEARS
**Shaft-mounted
Reducer** becomes
a part...on your machinery

Now you can mount single and double reducers as integral parts of your machines!

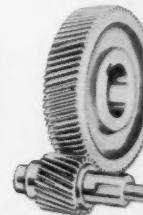
DBFG Shaft-Mounted Speed Reducers come as small as 7 1/8" wide and 10" deep. They can transmit 1/2 to 40 horsepower—at 10 to 490 r.p.m.

Standard DBFG bushings allow these reducers to be mounted on driven shafts from 1 1/8" to 3 1/8" diameter. Either torque arm (for infinite belt adjustment) or rigid flange-mounted models are available.

The reason for this surprising compact performance is DBFG Lifetime Gears. These gears are precision finished and hardened by a special process that requires no further machining after hardening. This means much greater gear capacity and longer life for all DBFG Speed Reducers. See the results in these Shaft-Mounted Reducers—truly "neat" power transmission!

**DAVID BROWN
FOOTE & GEARS**

26 Howden Road, Scarborough, Ont. Phone PL 5-5271
Send for our catalogue No. SMB



60-2

For further information mark No. 112 on Readers' Service Card



Ceiling with a New Look

The striking new appearance of the G. W. Robinson Department Store in Hamilton, Ontario is evident in this photo. Donald Perforated Metal is installed from wall-to-wall, completely covering unsightly heating and air-conditioning ducts and electrical conduits and wiring. The existing sprinkling system was not altered and will still operate effectively from behind the perforated panels.

Distributors Across Canada Head Office: Hamilton Ontario
Offices and Warehouses in Montreal, Winnipeg, Regina, Edmonton and Vancouver.

Donald "400" Perforated Metal ceiling sections are economical, easy to install and maintain. For further information on ceiling renovations please call our distributor, Dominion Aluminum Fabricating Ltd., 10 Jutland Road, Toronto.



D79R1

For further information mark No. 127 on Readers' Service Club

TEMPERATURE SENSING, MEASURING or CONTROL PROBLEMS?



This Specialized Field is Our Business

Qualified personnel with years of experience are at your service. With our complete design facilities we can work with you from the start to the finish of a complex problem.

On more simple problems stock components from our complete line are the answer.

QUALITY EXPERIENCE SERVICE

Catalogue Sheets and Engineering Data Sheets are available. Write for list of current bulletins.

**Thermo Electric
(Canada) Ltd.**
ENGINEERING - MANUFACTURING
P.O. BOX 10, BRAMPTON, ONTARIO

OFFICES ALSO IN MONTREAL—CALGARY—VANCOUVER

For further information mark No. 166 on Readers' Service Card

Briefs — *continued*

Ideas: One new idea enables housewives to **design** their own fruit flavored ice suckers right in the kitchen, using U.S.I.'s new plastic laminate pouch that freezes ingredients into a sausage shape; to eat, simply peel off the plastic like a banana skin . . . a **comparator** that automates individual selection and screening of a continuously moving stream of parts and materials by weight comparison . . . major breakthrough in processing urethane elastometer items is announced; a new resin is supplied in granular form to cut molding, injection and extrusion time from hours to seconds . . .

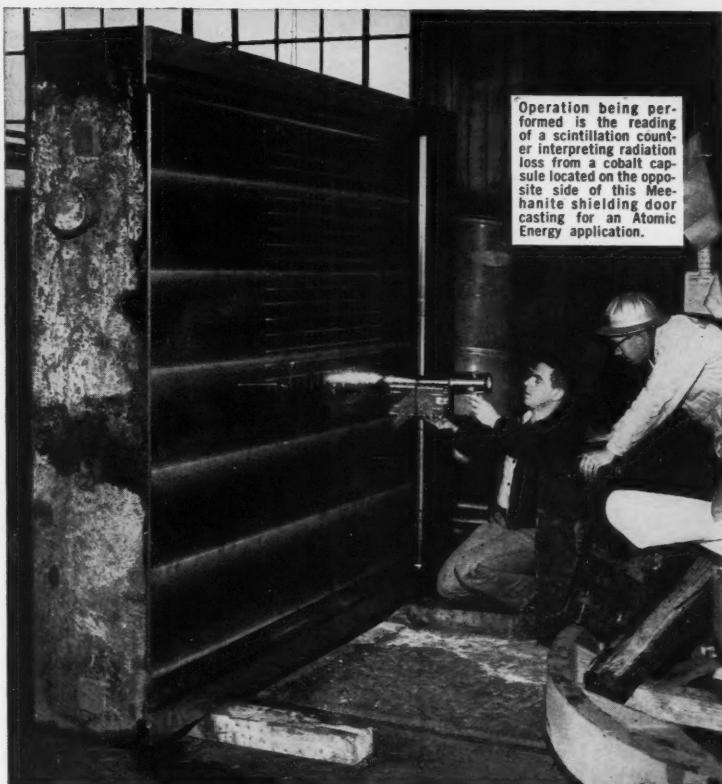
Shows: Latest **improvements** in industrial production equipment, techniques and study methods will be there for the asking at the National Industrial Production Show, Toronto, May 8-12 . . . First major event launching **Vancouver's** 75th birthday celebrations is British Columbia International Trade Fair, Exhibition Park, May 3-13; Japan is major exhibitor . . . **dry cleaning** is an exhibit feature at the International Packaging Exhibition, London, England, next September; one new gadget dry cleans narrow-neck bottles . . .

Universities in the news: Establishment of a **night university** in Toronto is being considered; DE suggests the sooner the better . . . want info on the **beat generation?** or chess? or auto design?—University of Ottawa has just published an indexed list of **experts** (complete with telephone number); one listing was omitted—**no expert on experts** . . . University of Illinois is constructing a **laser**, a cool light source better than the sun . . . University of Washington is accepting applications for research assistants in all branches of engineering, including nuclear; appointments become effective September 16 . . .

Synthetics: It's a good tip that you'll soon be wearing **synthetic paper** as a lining for your clothes; Du Pont has developed new synthetic fibres that will bond like wood pulp on standard paper-making machines to give a stronger more resistant material . . . **synthetic resins** and compounds can now be shipped in polyethylene bags developed by Union Carbide Canada Limited and approved by the Canadian Freight Association . . .

Talepiece: **Overheard** at the company pay-phone—"But operator, isn't there a special rate just for listening? I have to call my wife." *

MEEHANITE® MEANS BETTER CASTINGS



Operation being performed is the reading of a scintillation counter interpreting radiation loss from a cobalt capsule located on the opposite side of this Meehanite shielding door casting for an Atomic Energy application.

Specify Meehanite® For High Density And Solidity In Heavy Sections

Dimensions of the 85,000 lb. Meehanite casting above are 12'6" x 12'6" x 12" thick. Specific gravity tests, ultrasonic and radiation loss readings verify its uniform and controlled density.

In massive castings of this type which have a slow cooling rate, there is a natural tendency towards a more open structure with a corresponding loss in strength. However, in Meehanite castings the effect of "mass influence" is minimized through the use of constitutional carbide controls which are exclusive to the Meehanite Process. Breakdown of structure due to slow cooling is avoided by providing a definite degree of undercooling of the graphite to the melt.

In specifying the correct type of Meehanite metal for castings with very heavy or very light sections, the effect of mass influence should always be considered.

For detailed information, send for a free copy of bulletin TD-14-EFFECT OF MASS INFLUENCE. Write: Meehanite Metal Corp., New Rochelle, N.Y.

DORR-OLIVER-LONG, LTD.
Orillia, Ontario

HARTLEY FOUNDRY DIV.
London Concrete Machinery Co., Ltd., Brantford, Ontario

OTIS ELEVATOR CO., LTD.
Hamilton, Ontario

For further information mark No. 146 on Readers' Service Card

People and events

Introducing DE's new assistant editor

"Take Post" — these are the words that stimulate immediate action for DE's new assistant, **H. A. (Tony) Stevenson**. Tony, who hails from Brisbane, Australia, is one of the growing number of journalists from "down under" now working on Canadian trade publications.



Educated at Toowoomga Grammar School he is an external student with the University of Queensland with an eye on a B.A. His first journalistic experience was as radio news reporter with the Australian Broadcasting Commission and he later moved into television news as scriptwriter and editor. For eighteen months he owned a weekly suburban newspaper and sold out to sail with his bride, Fay, to their newly adopted land. He worked with a public relations agency in Toronto before joining DE.

Tony was commissioned as an artillery officer in Australia and is presently attached to 29th Field Regiment, RCA, Toronto. Like most of his countrymen he is a keen squash player and swimmer.

CSA monogram misused

Canadian Standards Association has successfully prosecuted an importer of plumbing brass equipment for illegal use of its registered trade mark — the CSA monogram.

CSA claimed in the Exchequer Court of Canada that certain products imported and distributed by the defendant had carried the CSA monogram which indicates certification by CSA Testing Laboratories. Since these products had not been certified, the improper use of the monogram was a breach of the Trade Mark Act 1953.

The action involved several wholesalers and retailers of plumbing brass

products who were ordered to recall the articles from sale and remove the CSA monogram.

Plastic process rights

Canadian rights to a United States process for molding liner-less closure caps from linear polyethylene have been acquired by Du Pont of Canada Limited. Rights were obtained from Dover Molded Products Company, Ohio, a subsidiary of Kessler Products Co.

The license also gives Du Pont exclusive rights to the new closure in 11 other countries: United Kingdom, France, Germany, Holland, Norway, Sweden, Denmark, Belgium, Luxembourg, Italy and Japan.

The new process enables production of caps, without liners, for all types of containers. It reduces cost and allows the caps to be molded in any color required for merchandising appeal.

\$750,000 valve plant

Imperial-Eastman Corp. (Canada) Ltd., manufacturer of tube fittings and valves, flexible and rigid hydraulic lines and fittings, is building a 23,000 sq ft plant in Barrie, Ont., at a cost of nearly \$750,000.

The company is a subsidiary of Imperial-Eastman Corp., Chicago, which was founded in 1905 by Canadian-born Charles McNellis, Sr.

Charles McNellis has been appointed vice-president and general manager of the new operation. Mr. McNellis, who has been with the company 21 years and was plant superintendent in Chicago for the last five, says the new plant is the first stage of a much larger operation.

It pays to argue

It pays to argue with the National Revenue Department. Last year one of every two appeals before the Tax Appeal Board or the higher courts was won by the taxpayer. The figures were 273 decisions handed down and 49% won by the public. This was a distinct improvement over 1959, when only one-third of the decisions were in the taxpayer's favor.



Ryan



Brunton

Association officers

Dr. Bristow Guy Ballard, O.B.E., has been elected president of the Engineering Institute of Canada for 1961-62. Vice-president (Scientific) of the National Research Council, he was awarded the O.B.E. for his wartime contributions including the development of protection against enemy magnetic mines.

L. Patrick Ryan, P. Eng., of St. Catharines, has been appointed to the permanent staff of the Association of Professional Engineers of Ontario. His duties will include formation of association chapters throughout the province.

Association of Professional Engineers of the Province of Manitoba has elected the following officers: C. S. Landon, president; R. E. Chant, vice-president; O. Marantz, secretary and registrar.

At the annual meeting of Industrial Instrument Manufacturers' Association in Toronto, H. W. Cowan of Daystrom Ltd. was elected chairman. E. J. Sheare, Taylor Instrument Manufacturers, was elected vice-chairman.

Company appointments

Dr. Donald C. Brunton, a former Ontario electronics and nucleonics engineer, has been appointed Director of Research for Industrial Nucleonics Corporation, Ohio. He was president and founder of Isotopes Products, Limited, Oakville, Ontario, and since 1957 has been product manager of the Nuclear Radiation Department of a large U. S. manufacturer.

James Nolan has been appointed manager of GRANCO division of Canadian Meter Company, Ltd. to take charge of all petroleum product sales through the firm's seven branches and its independent distributor organization.

E. W. Miller has joined RCA Victor Company, Ltd. as manager of technical products marketing for Quebec.

T. R. McLagan, president of the Canadian Manufacturers Association and of Canada Steamship Lines Ltd., has been elected a director of the U. S. owned Sperry Gyroscope Co. of Canada Ltd.

Dr. Donald C. Rose, OBE, has been appointed associate director of the Division of Pure Physics, National Research Council of Canada.

(Continued on page 78)

see what's NEW

'61 NATIONAL INDUSTRIAL
PRODUCTION SHOW of Canada

TO STREAMLINE PRODUCTION-TO CONTROL COSTS

Productivity Show Starts May 8th . . . Be there!

Learn how to increase productivity while controlling costs. Almost 400 exhibits . . . discuss your problems with suppliers . . . find out about the latest techniques and equipment for improving production while trimming costs. 5 big days! May 8-12. Be sure to attend!

Official Opening by The Hon. George Hees
Addresses by Prominent Speakers.

SPONSORS: American Society of Mechanical Engineers
Canadian Welding Society
Canadian Industrial Management Association
Canadian Council of Foremen's Clubs.

TORONTO MAY 8-12, 1961
INDUSTRY & COLISEUM BLDGS., EXHIBITION PARK

Show Office - 19 Melinda St., Toronto, EMpire 4-8068

For further information mark No. 149 on Readers' Service Card

Premium performance plastics
mean money saved



Nylon—rod, tubing, tubular bar,
strip, plate, disc
NYLATOR® GS (molybdisulfide
filled) nylon shapes and molding
compounds
MC Nylon—economical, tough
service nylon rod, tubular bar,
plate in large sizes
TFE-fluorocarbon—rod, tubing,
spaghetti tubing, tape, sheet, thin
wall tubing
FLUOROSINT® TFE-fluorocar-
bon mill shapes and molded parts
Cross-Linked Polystyrene
Penton Chlorinated Polyether—
mill shapes
Polycarbonate resin—mill shapes
NYLAFLOW® Flexible Nylon
Pressure Tubing and Hose

Economical, POLYPENCO stock shapes in several
nylons, TFE-fluorocarbons and other engineered
industrial plastics are unmatched for consistent
high quality and performance . . . and they are
available in the widest range of shapes and sizes
obtainable anywhere.

Polymer's specialized engineering help offers
you dependable, cost-saving production and end
product economy. Local warehousing means im-
mediate delivery. Detailed technical data and
complete application information are available on
all POLYPENCO materials and services.

Peckover's Limited : 115 McCormick St., Toronto
2052 St. Catherine St. W., Montreal
C. M. Lovsted & Co. (Canada) Ltd.: Vancouver
POLYPENCO, INC.
2150 Fairmont Ave., Reading, Pa., U.S.A.

For further information mark No. 154 on Readers' Service Card

**NINETY NINE NINE FIVE
HIGH PURITY MAGNESIUM**

DOMINION

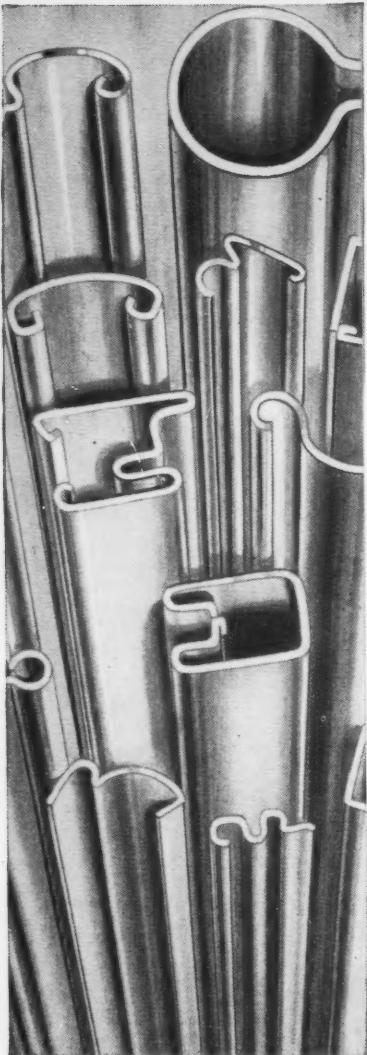
Domal Magnesium . . . produced in Canada . . .
has become a world traveller . . . welcome in
countries everywhere because of its high purity
and availability. Whatever your structural
or engineering application . . . if
it demands maximum lightness,
strength and versatility . . .
DOMAL MAGNESIUM is your metal.

Let us tell you of the many
achievements engineers the
world over are creating with
DOMAL MAGNESIUM. Write us soon.

MAGNESIUM LIMITED

320 Bay Street, Toronto, Canada

For further information mark No. 126 on Readers' Service Card



Custom Cold Roll and Brake Forming

Accurate, economical cold roll forming may solve a problem for you. Let's discuss it.

CRESSWELL POMEROY LIMITED

Head Office & Factory: Granby, Que.
ST. JOHN'S • HALIFAX • QUEBEC CITY
MONTREAL • TORONTO • WINNIPEG
EDMONTON • VANCOUVER

For further information mark No. 123

People and events

(Continued)

Tube firms merge

Welded stainless steel pressure tubing up to 2½ in. O.D. will be manufactured in a Scarboro, Ont., plant by a new company, Associated Tube Industries (Coldwater) Ltd., an associate of Oakton Products Ltd. (now known as Associated Tube Industries (Toronto) Ltd.). The latter company has for the past five years been making welded nickel alloy tubing up to ½ in. O.D.

The new company has acquired the assets of Tri-Bay Industries, which was engaged in the manufacture of welded stainless steel tubing at Coldwater, Ont.

H. J. Middleton, president of A.T.I. (Toronto) is president and general manager of the new company. J. K. Swinton is vice-president and manager, sales. The firms have a combined manufacturing area of 20,000 sq ft.

For your calendar

April 4-6: National Microfilm Association, annual meeting and convention, Sherman Hotel, Chicago.

April 10-21: American Welding Society, annual convention and welding exposition, Sheraton-Atlantic Hotel, New York.

April 10-11: Industrial Accident Prevention Association conference, Royal York Hotel, Toronto.

April 17: American Welding Society, 42nd annual meeting and welding show, Coliseum, New York.

April 28: Southern Ontario Chapter, American Institute of Industrial Engineers, convention, Royal York Hotel, Toronto.

May 3-13: Fifth U. S. World's Fair, Coliseum, New York.

May 8-12: National Industrial Production Show, Industry and Coliseum Buildings, Toronto.

May 11-13: American Institute of Industrial Engineers, national convention, Sheraton-Cadillac Hotel, Detroit.

May 17-19: Society for Nondestructive Testing, regional convention, Mount Royal Hotel, Montreal.

May 22-25: Design Engineering Show, Cobo Hall, Detroit.

May 30-June 2: Engineering Institute of Canada, annual meeting, Vancouver.

June 5-9: Plastics Exposition, Coliseum, New York.

June 15-24: International Construction Equipment Exhibition, Crystal Palace, London.

Designers' book shelf

An Engineering Approach to Gyroscopic Instruments, by Siff and Emmerich. Publisher—Robert Speller & Sons, New York. 120 pages. Price \$7.50.

Space ship guidance—inelastic navigation — nuclear gyro-magnetic moment—these are some of the key concepts of today's creative engineering effort related to gyroscopes. This book presents the pertinent information available on these subjects.

Starting out from a few special cases which are easily understood, the principles are applied later to the basic gyro configurations that form the foundation of practically all present-day gyroscopic instruments.

Circle 350 on Reader Service Card

Ultrasonics and its Industrial Applications, by O. I. Babikov, and translated from Russian. Publisher—Consultants Bureau Enterprises, New York. 225 pages. Price \$9.75.

While this volume covers recent Soviet advances in the ultrasonics field, its scope is universal and it will serve as an excellent aid to all engineers and scientists interested in the industrial applications of ultrasound.

The book discusses ultrasonic control methods, drilling techniques, pulse methods of flaw detection, and the action of high-intensity oscillations on various technological processes.

Circle 351 on Reader Service Card

Handbook of Noise Measurement, by A. P. G. Peterson and E. E. Gross, Jr. Publisher—General Radio Company, West Concord, Mass. 130 pages. Price \$1.00.

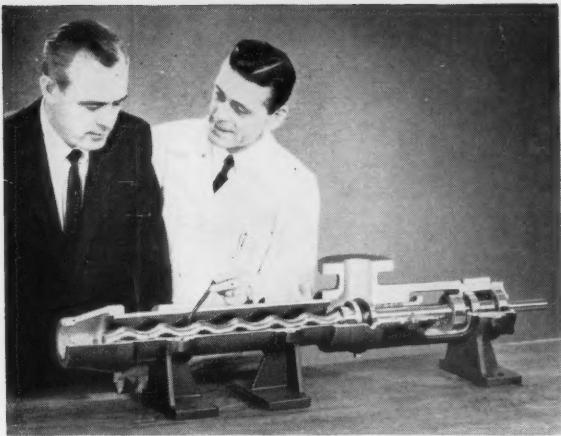
An illustrated handbook covering the measurement of noise and vibration, and describing equipment requirements, procedures and the interpretation of results. Its thirteen chapters offer a fairly comprehensive survey of such topics as the decibel, application of sound-measuring systems and the measurement of sound levels.

Circle 352 on Reader Service Card

Ingenious Mathematical Problems and Methods, by L. A. Graham. Publisher—Dover Publications, New York. Price \$1.45.

Here's an interesting collection of mathematical problems selected from a most unusual puzzle column. If you think your maths quotient is above par, then these little teasers will certainly test you—and you can have plenty of entertainment also, testing your friends and fellow engineers.

Circle 353 on Reader Service Card

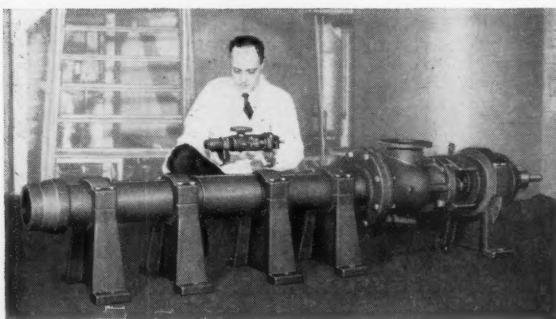


Let MOYNO'S. "Progressing Cavities" Cut your Pump Maintenance Costs!

MOYNO's unique "progressing cavity" principle cuts pump maintenance costs because material being moved contacts only one moving element. MOYNOS are constructed to stoutly resist corrosion and abrasion. As shown in the cutaway model above, MOYNO's screw-like rotor revolves in a double-threaded stator forming "progressing cavities" that move material smoothly along, without foaming, aerating or crushing. Even where duty is so tortuous that rotor must be made of special resistant materials, MOYNO parts show little wear.

In industry everywhere, and on OEM applications, MOYNOS are proving "if it can be pushed through a pipe . . . MOYNO will pump it!" Typical materials pumped include non-pourable pastes, abrasives, slurries, chemicals, foods, acids, even suspended solids up to one inch in size. Many materials now successfully pumped by MOYNO were once considered "unpumpable" . . . had run up prohibitive maintenance costs on other type pumps or ruined them completely.

Capacities are available up to 500 gpm and pressures up to 1000 psi. Off-the-shelf replacement parts are always immediately available. No doubt your plant flowsheet or OEM product has a spot where MOYNOS can cut costs drastically. To find out how, write today for Bulletin 30-C!



capacities to 500 gpm; pressures to 1000 psi

THE ROBBINS & MYERS COMPANY
of CANADA LIMITED—BRANTFORD, ONTARIO



Fractional & Integral H.P.
Motors & Generators



Moyno
Pumps



Propeller Industrial
Ventilating Equipment



Electric
Fans



Electric & Hand
Hoists & Cranes

For further information mark No. 157 on Readers' Service Card

DESIGN ENGINEERING APRIL 1961



Precision MOLDED "O" Rings and Dyna-Seals



Made to extremely close tolerances with accurately finished surfaces, Precision "O" Rings and Dyna-Seals provide positive leak-proof sealing through wide ranges of temperature and pressure.

Made to all military and commercial specifications in hundreds of sizes, Precision Products cost less per hour of service life.

Ask for copy of Engineering Handbook.

6101

Precision Rubber Products
(CANADA) LTD.
"O" Ring and Dyna-seal Specialists
Toronto, Ontario. Ste. Therese, Quebec.

For further information mark No. 155 on Readers' Service Card

79

REMOTE BULB, INDICATING TEMPERATURE CONTROL E32N

Type
E32N

**Featuring
Control Point
Accuracy Equivalent
to Individually
Calibrated Instruments**

The UNITED ELECTRIC Type E32N Temperature Control is a uniquely designed instrument that is used to control and indicate temperatures of gases, liquids or hot plates over wide ranges. This unit contains a 12-inch scale for easily read visual indications. It is possible to replace the thermal unit in the field without any loss of calibration accuracy.

Temperature Ranges.....	-150°F. to 150°F., 70°F. to 370°F., 100°F. to 650°F. Read temperature on continuous, 12-inch indicating scale that rotates against a fixed index pointer in a vertical and centered location.
Switch Ratings.....	Up to 15 amps. at 115 or 230 volts A.C. 20 amp. A.C. or D.C. switches also available.
Switch Types.....	N.O., N.C., or Double Throw — no neutral position.
On-Off Differential.....	Approximately 1.0°F. or 2.0°F. dependent on model.
Adjustment.....	Calibrated dial rotated against a fixed index.
Calibration.....	Calibrating mechanism permits precise matching of scale to individual tolerance errors of thermal assemblies.
Compensation.....	Automatic compensation for ambient temperatures.

UNITED ELECTRIC manufactures a complete line of temperature, pressure, and vacuum controls. For applications requiring custom-built units or modified standard units, call upon a UE application engineer for recommendations. Complete data is available for the Type E32N as well as for all standard UE controls.

UNITED ELECTRIC

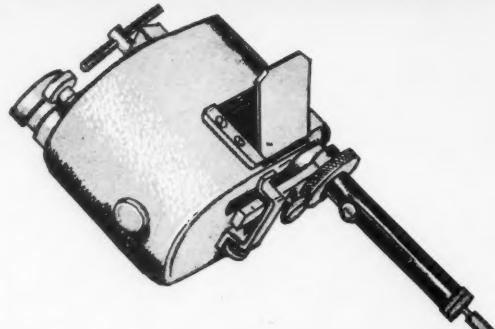
CONTROLS (CANADA) LTD.



35 O'Connell Ave.
Dorval, Quebec, Canada

For further information mark No. 170 on Readers' Service Card

ASKANIA HAND VIBROGRAPH



This compact, lightweight vibrograph is very versatile. Here are a few of the many applications.

- ✓ measurements on turbines
- ✓ testing machine tools
- ✓ vibrations of a lathe
- ✓ measuring efficiency of shaking devices
- ✓ paper mill applications
- ✓ measurements on autos
- ✓ vibrations on buildings
- ✓ balancing
- ✓ torsional vibrations
- ✓ pressure vibrations

Write for 16 page descriptive brochure.

CANADIAN DISTRIBUTOR

**JAMES STEVENSON
AND COMPANY LIMITED**

15 St. Mary Street, Toronto

Toronto:
WA 1-0460

Ottawa Office:
CENTRAL 4-4374

For further information mark No. 164 on Readers' Service Card

EQUIPMENT USED IN EVERY INDUSTRY

Remote supervisory control
Dissolved oxygen equipment
High frequency heaters and
Sealers for plastics
Coil winding machines
Dry plate rectifiers
CO & CO₂ equipment
Voltage regulators
Measuring machines
Battery chargers
Control panels
Power supplies
Gas analyzers
Switchboards
Annunciators

and these instruments:

Bridges, galvanometers, potentiometers
Indicators and recorders
Industrial thermometers
Temperature regulators
Electrical instruments
Insulation testers
Signal generators
Ground testers
Stroboscopes
Multi-meters
Tube testers
pH equipment
Stop watches
Tachometers
Pyrometers

CONTRACT MANUFACTURING—Instrument repairs—Engraving
Canadian Representatives for:
"Avo" "Megger" "Cambridge" "Regohm"

R.H.
Nichols
LIMITED

569
4544 DUFFERIN STREET, TORONTO

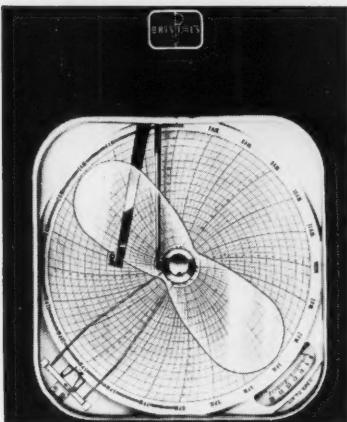
TORONTO MAIL:
P.O. Box 500
DOWNSVIEW, Ontario

VANCOUVER
624 Vancouver Block
736 Granville Street

For further information mark No. 150 on Readers' Service Card

New products and materials

Recorder controller



A single-case time-program recorder controller affords 50% reduction in panel space requirements. Recorder chart and the program cam are separately driven. Program time may be from 30 sec to 30 days. **Bristol Company of Canada Limited.**

Circle 354 on Reader Service Card

Flaw detector

Equipped with a newly developed caliper attachment, this ultrasonic flaw detector may be used to measure thickness of metals and plastics, from one side, to accuracies with ± 0.010 inch. Shop personnel can learn to use the caliper efficiently within a few minutes. A reference block of known thickness—the same material to be tested—is used to calibrate the instrument. **Branson Instruments, Inc.**

Circle 355 on Reader Service Card

Level controller

Have you a problem indicating or controlling the level of a liquid, powder, granular or lumpy material? Here is a new unit that is claimed will solve that problem. Single, duplex, triplex or multiple models are available with a wide variety of probes. **Brian Engineering Limited.**

Circle 356 on Reader Service Card

Strain gauge

A new bending-separator gauge which will separate and identify tensile strains and strains produced by bending moments on the surface of a structure. Major feature is that it can be mounted on one side of the structure only, thus eliminating the need for back-to-back mounting of strain gauges both inside and outside of such structures as pressure vessels and aircraft wings. **Budd Company.**

Circle 357 on Reader Service Card

Computer translator

New magnetic tape translation devices have been developed for lower-cost input conversion of foreign tape formats and signals. Tapes are translated making use of the reading computer's ability to edit information by converting pulse shapes, format and timing into the form normally supplied by the computer's own tape readers. **Auerbach Electronics Corporation.**

Circle 358 on Reader Service Card

Pipeline control

A new explosion-proof pressure control especially for pipelines has been developed. Two completely separate switches permit control of two independent circuits to simulate double pole circuitry. Several models are available with ranges between limits of 20 and 1,700 psi. Known as the H98A unit. **United Electric Controls Canada Limited.**

Circle 359 on Reader Service Card

Pressure indicator

A compact integrated unit (weighs $4\frac{1}{2}$ lb) for pressure indicator applications. A momentary contact switch electrically unbalances the strain gauge bridge to 80% full scale, to permit checking the calibration of the entire indicator-transducer system. Adjustments for span and electrical zero are easily made. **Taber Instrument Corporation.**

Circle 360 on Reader Service Card

Temperature controller



Here's a unit that controls indoor temperature based on outside conditions. Fully transistorized, working with thermistor temperature detectors. Built-in 7-day electric clock with week-end features, night shutdown and morning boost. **Acme Engineering Co.**

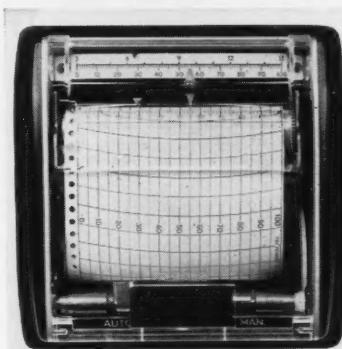
Circle 361 on Reader Service Card

Plug-in dial timer

Exclusive safety and conversion features are incorporated into this plug-in dial timer. It is particularly suitable for industrial processing operations in which downtime for replacement purposes on high production machines is extremely costly. **Automatic Timing and Controls.**

Circle 362 on Reader Service Card

Cascade control



A remote control station containing all the panel-mounted components needed for pneumatic cascade control of a process is now available. The cascade station can receive measurements from two different points in the process, recording them on the one chart. **Foxboro Company.**

Circle 363 on Reader Service Card

Precision pivots

A new line of precision pivots is available for sensitive instrumentation. Manufactured to tolerances of .0001 inch they have a hardness of 65 on the Rockwell C scale. Non-magnetic pivots are also available for low energy instruments. **Welton V. Johnson Engineering Company, Inc.**

Circle 364 on Reader Service Card

Hand vibrograph

A compact, light-weight vibrograph that can be held in the hand has been developed in Germany for measuring vibration. It can also be used for static measurements, like a simple displacement meter, if clamped in a vise. **James W. Stevenson and Co.**

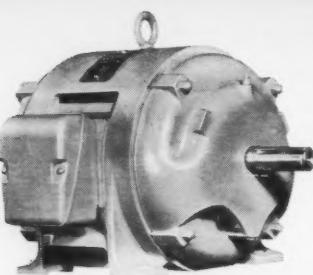
Circle 365 on Reader Service Card

Triplex plunger pump

The new PT-4 triplex plunger pump offers compact design with high volumetric efficiency. It operates 70 hp input at 400 rpm. **Gardner-Denver Co.**

Circle 366 on Reader Service Card

(Continued on page 82)



More and
more
Canadians
specify

BROOK MOTORS

Day by day, more and more Canadians are specifying Brook Motors. They know that stators, rotors, windings, electrical varnishes and bearings found in a Brook Motor are designed and selected to give the longest, trouble-free service anywhere in Canada any time of the year. Brook Motors cost no more—usually cost less. That's why Canadian industry specifies Brook Motors, SEMA (Open Drip Proof Shown) and Standard Frame Motors, 1 to 600 horsepower, available from warehouse stocks in principal cities. Write for full details today!

SINCE 1904/World's most respected motors

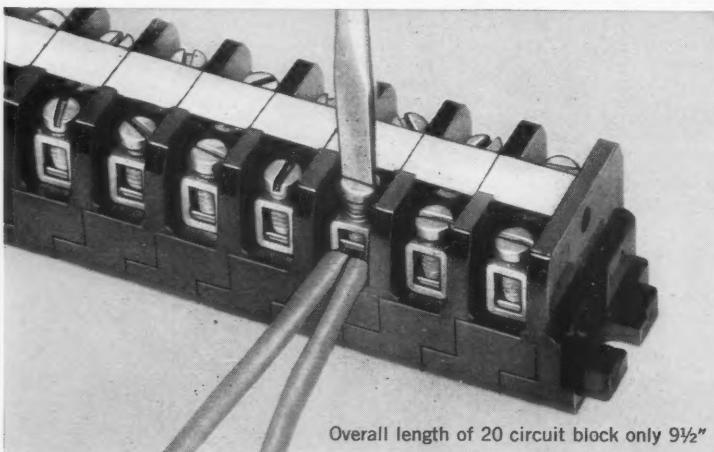
BROOK ELECTRIC MOTORS

OF CANADA LIMITED / 250 University Avenue, Toronto, Ontario

Representatives in: St. Johns, Quebec, Montreal, Toronto, Guelph, North Bay, Winnipeg, Regina, Calgary, Edmonton, Vancouver.



For further information mark No. 111 on Reader Service Card



Overall length of 20 circuit block only 9½"

40 Amp. Capacity in 7/16" C. C. Space Same As Most 15 Amp. Barrier Strips

Buchanan has this . . . and more. No terminals, no lugs, fewer wiring problems when you use Buchanan sectional MD pres-SURE-blocks with tubular contacts. And, you can group more common wires—equal to 1 #22 thru 1 #8—under a single contact. Just 2

different snap-fit parts build any length Buchanan MD block . . . with more "wanted" features than conventional blocks. Strap screw contacts also available. Write now for Bulletin ED-4

Tubular contacts listed by UL.
Blocks listed for 600 volts by CSA.
U. S. Pat. No. 2,922,139



**BUCHANAN ELECTRICAL
PRODUCTS CORPORATION
HILLSIDE, NEW JERSEY**
In Canada: ESNA CANADA LIMITED, Toronto 16



SEE US AT BOOTH NO. 220 AT THE ISA SHOW, TORONTO, JUNE 5-8

For further information mark No. 114 on Readers' Service Card

New products

(Continued)

Electric reset counter

A reset counter that operates by remote pushbutton, mechanical switch, photoelectric electronic or other type of relay. It counts at speeds up to 1,000 counts per minute. **General Controls Co. (Canadian) Ltd.**

Circle 367 on Reader Service Card

Strip chart recorder

A compact multipoint strip chart recorder, 8½ inches high that will scan and measure 2 to 12 input sources at a rate of 5 seconds per point. Calibrated chart width of 11 inches. **Westronics Inc.**

Circle 368 on Reader Service Card

Fault locator



A new instrument for rapid, accurate location of faults in multi-conductor lead shielded cables, by direct reading. Completely designed in Canada. **Canadian Research Institute.**

Circle 369 on Reader Service Card

New transformer

A current transformer, with accuracy permitting its use with wattmeters as well as ammeters, is now available in Canada. It conforms to ASA-C57.13 standards of accuracy. **Daystrom Limited.**

Circle 370 on Reader Service Card

Radioactive control

A solenoid valve that will control radioactive corrosive chemical solutions, even in a radiation field as high as 25 million rads. It is available for use in pressure and vacuum systems, and handles such solutions as nitric acid, hydrogen peroxide, ammonium hydroxide, sulphuric acid and sodium hydroxide. **Keyes, Martin & Company.**

Circle 371 on Reader Service Card

Valve positioner

A pneumatic valve positioner that employs a characterized cam, pneumatic relay, control bellows, beam and nozzle-flapper arrangement. Available with or without bypass and pressure gauges. **Fisher Governor Company.**

Circle 372 on Reader Service Card

New products

(Continued)

Tracing vellum

A brilliant new transparentizing resin matched with a fine grade rag paper has resulted in a new quality tracing vellum with superior strength and attractive visual appeal. The surface will accept drawing ink without skipping, feathering or spreading. Pencil lines may be erased from one spot at least 10 times without damage to the surface, and ink lines at least three times. **General Aniline & Film Corp.**

Circle 373 on Reader Service Card

Digital memory drum

A magnetic memory drum that is particularly suited to program control of multiple-cutting machine operations, and presents recorded information whether in motion or stationary. **Consolidated Controls Corporation.**

Circle 374 on Reader Service Card

Silent sleeve bearing

A new sleeve pillow block which generates a hydrodynamic oil film between the integral sintered bronze bushing and the hardened steel rotating sleeve, has recently been patented. **Tann Corp.**

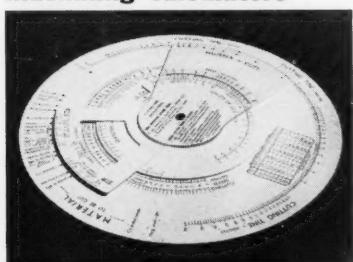
Circle 375 on Reader Service Card

Paper flaw detector

An automatic device for detecting small flaws in sheets of paper is now operating successfully in two Ontario paper mills. It is fitted with a memory mechanism which ensures that the sheet containing the flaw is the one rejected after the cutting operation. **Electronics Associates Limited.**

Circle 376 on Reader Service Card

Machining calculators



A range of British time calculators is now available for determining production times for most general machining operations. Three sections on the circular slide-rule type calculators measure cutting, loading and manipulation times. Information on correct speeds and feeds is built into the calculator but there is provision for users who wish to include information gained from their own experience. **Fearns, Mears & Co.**

Circle 377 on Reader Service Card

is this the missing component
in your instrumentation
problem?



AVIATION ELECTRIC'S NEW BALL RESOLVER

A new miniature calculator that has many applications in the general field of engineering design is currently being manufactured by Aviation Electric Limited of Montreal. The unit illustrated is being used with great success in Canada for the automatic calculation of sine, cosine and tangents in advanced navigational systems. Compact and light in weight, this resolver offers great accuracy of performance under the most rigorous conditions.

Based on a 19th century invention, the principle behind the new resolver is remarkable in its simplicity. Aviation Electric engineers, however, had to overcome many difficulties of design to develop a miniaturized instrument capable of instantaneous and continuous calculations to an accuracy greater than 0.3%, under conditions of great stress, with a temperature variation from +160°F. to -65°F.

Miniature resolvers are destined to play an important part in guided missile control and future technological advances of many kinds. Aviation Electric will be glad to discuss the application of this new ball resolver to your instrumentation problems and, if necessary, to design an entirely new unit for your purposes.

For further details and illustrated literature write to:

AVIATION ELECTRIC
L I M I T E D

200 Laurentien Blvd., Montreal, P.Q.

Branch Plant:

Aviation Electric Pacific Limited, Vancouver Airport, Vancouver, B.C.

For further information mark No. 106 on Readers' Service Card

Overheard in Ottawa

Japanese break embargo?

Some "relatively small" shipments of Japanese electronic tubes have been shipped to Canada through the United States since Japan imposed its embargo, according to Revenue Minister George Nowlan. The Minister told the Commons two shipments were made in the

fall and two more in November-December.

The tubes were valued for duty in Vancouver at the effective selling price of tubes in the United States.

There have been no direct shipments to Canada since the embargo was im-

posed, except for those that were already on their way. Negotiations are now being made to set import quotas for 1961, but there are no immediate signs of success.

Attracting industry

The wheels began turning on the federal government's scheme for attracting new industries to depressed areas only four days after the program was announced.

A mayor of an Ontario municipality (whose name is not to be disclosed) wrote Labor Minister Michael Starr, as soon as he heard of the plan to grant tax concessions to new industry. It reached the Minister on March 7 and that same week two government investigators were on their way to determine the area's eligibility.

Reliable department sources say about 15 municipalities can qualify under the complicated formula, but no official number is being given. The tax concession allows new industries (not those already established) to claim double depreciation for any one of the first three years' operation in a depressed area.

"Buy Canadian" bill

Recent moves have failed in an attempt to give Canadian companies absolute preference over foreign competitors in bidding for federal government contracts. A private MP's bill sponsored by Ernest Broome (PC, Vancouver-South) won unanimous support in principle from all parties but was talked out.

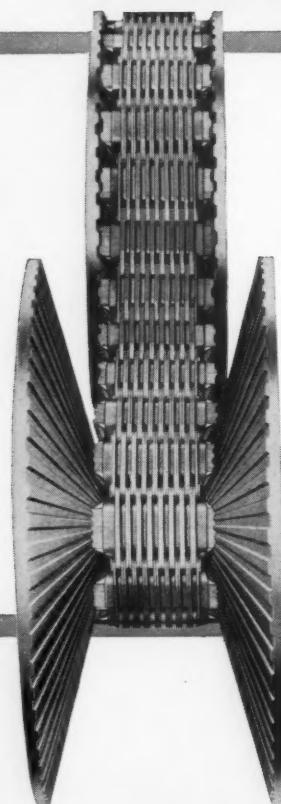
It also sought a 10% preference for non-Canadian supplies owned by a Canadian company over supplies tendered by a non-Canadian company. Exceptions were for goods and services not available in Canada, or in cases where cost or quality margin was excessive.

Canadian regulations dated 1921 merely require government departments to buy Canadian but they do not cover crown corporations such as Atomic Energy, CMHC, CNR and TCA — all very large purchasers.

Write-off on tools

All tools costing less than \$100 may now be completely written off in one year for tax purposes. This is the result of an amendment to the Income Tax Act raising the maximum small tools' cost for full 100% depreciation from \$50 to \$100.

Tools costing more than \$100 qualify for varying depreciation rates, normally 20%.



For a variable speed gear which is *positive* there is no alternative to the P.I.V. It is absolutely positive as the patent chain and wheel faces ensure "No Slip". An infinite variation of speeds up to a range of 6 to 1 can be obtained. The speed can be adjusted under load and will remain constant.

The high efficiency is maintained as the correct engagement of the chain with the discs is independent of stretch and other related factors. The gear has a very long life as no part is subject to wear except the chain; the life of which depends on the load, but can be reckoned in years.



FOR DETAILED
INFORMATION
WRITE FOR
ILLUSTRATED
CATALOGUE.

CANADIAN REPRESENTATIVES

STONE FRANKLIN OF CANADA
LIMITED

MONTREAL: 7035 Grand Ave., CR. 1-2397

TORONTO: 603 Royal Bank Bldg., EM. 3-9033

For further information mark No. 162 on Readers' Service Card

Overheard in Ottawa

continued

Research aid sought

Strong recommendation for greater federal government support of industrial research has been made by the Canadian-American Committee, a private group of influential businessmen and labor leaders from both sides of the border.

The committee claimed there appeared to be very little, if any, positive government encouragement to research, backed up by tax concessions or other inducements to foster its development.

It also claimed there was little evi-

dence that U.S. subsidiaries lagged behind comparable Canadian companies in research expenditures in Canada. But it did find cases where research could be undertaken in Canada and wasn't.

The modern home

According to a Bureau of Statistics report most Canadian homes are fairly well equipped with modern conveniences and labor-saving devices. Nine in ten families own refrigerators 96% own radios and 83% have television sets.

But one quarter of the families still own hand or foot operated sewing machines and more than one in ten heats his home with wood.



"Who used the copying machine last?"

MADE IN CANADA



IH-380

your most experienced source for **METAL HOSE** and FITTINGS

...to control the effects
of pressure, temperature and
motion in the conveying
of any medium

Flexonics offers the broadest line of standard hose and fittings available in corrugated or interlocked. Whatever the job calls for in type of metal or special packing, you can depend on Flexonics greater depth of product and experience to provide the answer—and quickly! Standard sizes up to 24 inch I.D.

Write for your free copy of
Flexonics complete Metal
Hose & Fittings Design Guide



Flexonics

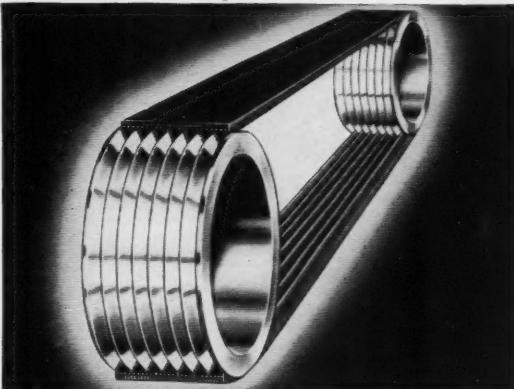
FLEXONICS CORPORATION OF CANADA, LIMITED
134-D Nelson St. W., Brampton, Ont.

Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components
Formerly Canadian Metal Hose Corporation, Ltd.



For further information mark No. 133 on Readers' Service Card

CONVERT TO R/M POLY-V® DRIVE!



NO OTHER DRIVE DELIVERS AS MUCH POWER IN AS LITTLE SPACE!

- MORE POWER — LESS SPACE . . . with Reliability
- SINGLE UNIT DESIGN
- ELIMINATES BELT "MATCHING" PROBLEMS
- MAINTAINS GROOVE SHAPE
- CONSTANT PITCH AND SPEED RATIOS
- LESS WEAR ON BELT AND SHEAVES
- COOLER, SMOOTHER RUNNING
- COMPLETE CONTACT-PRESSURE
- TWO BELT CROSS SECTIONS MEET EVERY HEAVY DUTY POWER REQUIREMENT

Poly-V is patented

Write For Bulletin

RM1013

Engineered Rubber Products... More Use per Dollar

RAYBESTOS-MANHATTAN(Canada) LTD.
PETERBOROUGH



For further information mark No. 156 on Readers' Service Card

GKF

the finest bearings in the world
—precisely!

For further information mark No. 118 on Readers' Service Card

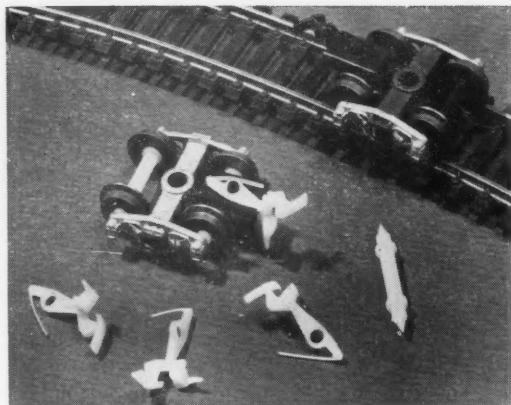
Ideas round-up

One-piece Delrin coupler replaces two-piece assembly

A two-part assembly consisting of nylon coupler and steel coil spring has been replaced by a unique one-piece spring coupler for a model train. The redesign was achieved by a combination of the mechanical properties of Delrin acetal resin and an automatic molding technique. The design change means savings in assembly costs, more positive working action and improved appearance.

The company concerned, the Lionel Corp., had to find a material with a high modulus of elasticity to replace a coil spring. The material also had to have high tensile and flexural strength, good impact strength to withstand shock loading, and dimensional stability. Delrin and the automatic molding technique provided the answer.

Delrin also solved another problem for Lionel designers. The model train uses a two-rail track (positive and negative terminals), so its freight truck required an insulating material to prevent shorting through the steel wheels and axles. This meant a costly assembly in materials and labor. Switching to plastic axles would fulfil the need for insulation, but would plastics meet the requirements of rigidity and mechanical strength? Axle rigidity is important because the steel wheels always make contact with both the positive and negative rails.



Tests showed that of all plastics materials available, Delrin came closest to the characteristics of stiffness over a wide temperature range, low coefficient of friction, high flexural strength, light weight and excellent electrical insulation.

"Locking insert" cuts installation cost 30%

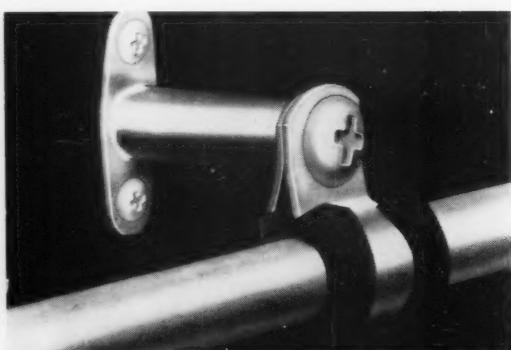
A simple fastening assembly with a "screw-lock" insert gives improved support for securing electrical wiring bundles, hydraulic tubing, plumbing lines and heater ducts in aircraft and missiles. The device also reduces space requirements, increases rigidity and vibration resistance, and can cut installation costs 30%.

Previously, sheet metal clips and brackets were attached to the airframe in various configurations to support wiring and tubing. To make them fit, special

designs were required involving costly engineering time, special punch press tooling and frequent re-work. Wire and piping were fastened to clips with loop-type clamps which in turn were attached to the airframe by means of bolts, nuts, washers and lock wires.

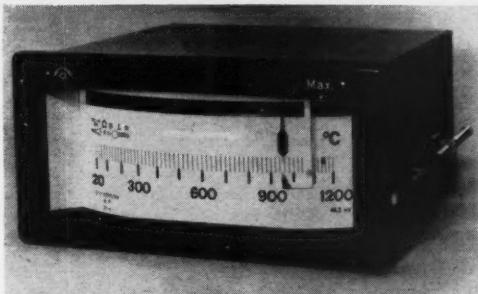
The demands of increased hydraulic pressures and the tremendous strains imposed by water injection in jet engines created a need for fasteners that would withstand high vibratory and other stresses. The need was answered in an assembly design incorporating the screw-lock insert. The fastener replaces combinations of nut plates, tube spacers and attachment lugs; no clearance hole is required and thus the structural member is not weakened. No troublesome brackets are required, nor spacers, tube spacers, taper washers, nuts or lock washers.

In use, the mounting bolts are held securely against loosening by grip coils near the centre of the screw-lock inserts. Instead of being circular, these locking coils approximate a polygon in shape. As the bolt is run through the insert, the grip coils are forced to conform to the thread circle. The resilient cords of the grip coils maintain a strong, spring-like pressure on the bolt, giving it a locking effect which is not diminished through repeated disassemblies. Sources: Western Sky Industries.



Stock Delivery for:

INDICATING and RECORDING CONTROL INSTRUMENTS for all temperatures for: Foundries, Heat Treatment, Compression and Injection Moulding Machines, Record Presses, Preheaters, Ingots, Press Moulds, etc.



Temperature Indicators
Automatic Controllers
Temperature Recorders
Surface Pyrometers
Immersion Pyrometers
Micro Pyrometers
Optical and Radiation
Pyrometer
Automatic Process Control

Gauges: For Pressure, Vacuum, Humidity,
Temperature U-Tube
Instrument Repairs

THERMOVOLT INSTRUMENTS LIMITED

BE. 1-7434
BE. 1-7134
Toronto 18

P.O. Box. 43
Ontario

For further information mark No. 167 on Readers' Service Card

New!

DUAL-LOCK... A high-load structural fastener

Here's a new high-load, positive-locking structural fastener that can cut your assembly costs on demountable buildings, shipping containers, aircraft cowlings, etc.

Check these Dual-Lock features:

- Double-acting take-up insures heavy closing pressure; provides pressure-tight seal when gaskets are used.
- Trigger action insures full open and full closed positions.
- Vibration-proof and impact-proof.
- Easily installed; can be recessed in panels or surface-mounted.
- Withstands 7000-lb. tension.

Write today for samples and 40-page catalog.

SIMMONS FASTENERS

Quick-Lock • Spring-Lock • Roto-Lock • Link-Lock • Dual-Lock • Hinge-Lock

SIMMONS FASTENER CORPORATION

1776 North Broadway, Albany 1, N.Y.

For further information mark No. 159 on Readers' Service Card
DESIGN ENGINEERING APRIL 1961

TO SAVE COSTS

Use

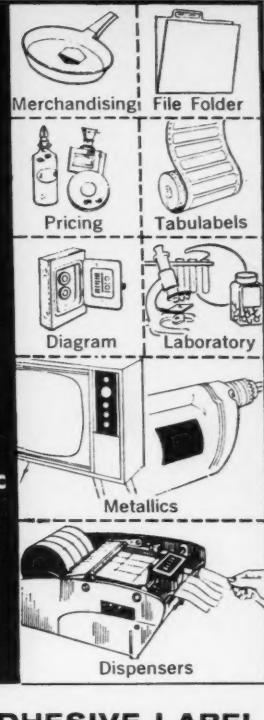
AVERY PRESSURE-SENSITIVE LABELS

AND AVERY VIBRANT

METALLICS

APPLIED WITH
MANUAL AND AUTOMATIC

AVERY LABELLERS DISPENSERS IMPRINTERS



AVERY ADHESIVE LABEL

48 HAAS ROAD, REXDALE, ONT.
BRANCHES: ST. JOHN, MONTREAL, TORONTO,
WINNIPEG, VANCOUVER

For further information mark No. 105 on Readers' Service Card

PROBLEMS!

Call in 

We can assist you in the measurement and control of:
level — humidity — time — temperature — speed
— flow — density — turbidity — weight — thickness

. . . and with

batching, counting, sorting, ultrasonic cleaning, metal detection, automation, photo-electric controls and industrial television.

Measurement and Control Equipment for Industrial Automation

MEASUREMENT Engineering Limited



HEAD OFFICE AND PLANT, ARNPRIOR, ONTARIO

- Montreal: Phone NA. 7-4313
P.O. Box 1352, Postal Station "O".
- Toronto: Phone HU. 1-0231
1969 Avenue Road, Toronto, Ontario.

For further information mark No. 145 on Readers' Service Card

backlash

A P.Eng speaks . . .

Upon being registered as a Professional Engineer a person automatically must assume the responsibilities which have been given to the Association to ensure that the affairs of the Association are conducted properly . . . it is apparent that the duties and powers of Council have been steadily expanded and broadened to meet changing conditions . . . so that a great deal of work beyond the administration of registration and discipline procedures appears on the agenda each year . . . it is conceivable that the problems that arise regarding the well-being of engineers would be better handled by a Society which would be separate and apart from the Association as presently constituted.

*W. Hall, President
Association of Professional Engineers of B. C.*

and another one . . .

I wonder if the time has come to separate the licensing and welfare functions of the Corporation? Initially being considered as solely a licensing and disciplinary body whose prime function was the protection of the public, we have seen the Corporation assume an ever growing welfare function. It was realized that if the Corporation did not assume the welfare function, assuredly some other form of organization would do so.

But the organization of the Corporation was not set up to handle both functions concurrently and I suggest that perhaps a separation of the two functions might make for an even more efficient organization than at present exists.

*Geoffrey, Webb, P.Eng., in Bulletin of
Corporation of P.Engs. of Quebec*

Mass translation

The Soviets employ over 2,000 full-time and 20,000 part-time workers who abstract and translate technical articles from the outside world and have them ready for Russian scientists and engineers about 4-6 months after initial publication. Canada is doing little or nothing in this field, while the U. S. counterpart system has only 1,700 part-time workers, and takes at least a year to prepare foreign articles for study.

Hit-or-miss hunting

Corporate recruiting for engineers—on college campuses and off—is causing considerable unhappiness in all quarters, according to recent studies by the American Management Association.

Almost 25% of companies questioned described their own campus recruiting methods as inadequate. Students were the most dissatisfied. They complained of discourtesies, companies that were using the campus as an advertising medium and had no intention of hiring, and interviewers that were plainly incompetent.

Industrial design school?

Speaking before the Fashion Group in Toronto recently, Mr. Henry Strub, co-ordinator of design for Alcan, proposed that a school of industrial design should be established in Canada. He further stated that, "Some of us in Montreal have proposed to the Premier of Quebec the creation of a provincial design center to consist of three elements:

1. A design school, empowered to award a university degree, also to teach graduate courses in industrial design, graphics, package and other allied branches of industrial design.
2. An exhibition center at which the best in industrial design from all over the world, as well as from Canada, could be shown to the students and the public.
3. A design information service consisting of a design index of all consumer products that achieve a reasonable standard of design, an information and consulting service for industry.

Over a period of time such a center would stimulate the establishment of a Canadian tradition in design and we would lead in fields where hitherto we have been content to follow."

DE agrees wholeheartedly with Mr. Strub's proposal for a university level of education in the industrial design field in Canada, whether it be established in Montreal or elsewhere in the Dominion. We must however, protest the proposal to set up a second design information service and design index. Unless, of course, the proposed center were to be allied closely with and operated by the present Centre in Ottawa. In that case we would like to double the proposal, and suggest that two new Centers be created, one in Montreal and the other in Toronto. Now that the Design Center in Ottawa has been taken over by the Department of Trade and Commerce (see Design Engineering, January 1961, page 58) we are looking for renewed activity from the Center and the type of leadership that the Canadian designers so urgently need. Perhaps if the designers themselves were permitted to have a greater say in the activities of the Center, the results might be revealing. It's worth a try.

STOP PRESS NEWS Montreal Chapter Fluid Power Society

The first meeting will be held at the Mount Royal Hotel in downtown Montreal on Thursday, April 6 at 8 p.m. A guest speaker from the U. S. will address the meeting. All those interested in knowing more about fluid power technology are welcome. This includes students, users, manufacturers, distributors, and engineers.

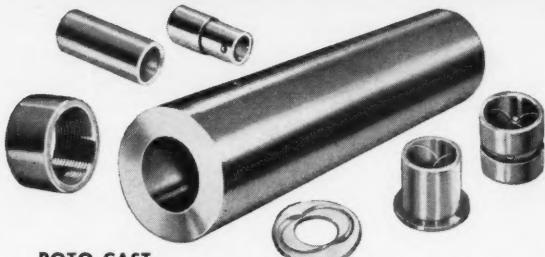
. . . Plan now to attend . . .

. . . Be a charter member . . .

**FOR QUALITY AND ECONOMY IN
PRODUCTION**



**Central Bronze Bars or
Precision Finished Bronze Bushings**



ROTO-CAST

The high quality castings resulting from the advanced ROTO-CAST process offers Industry a bronze bar as perfect as metal can be—no hard spots, no sand or gas inclusion, no shrinkage cracks—dense, fine-grain structure throughout. Cut scrap loss 15% to 50%—40% to 60% longer wear.

Write for our stock and weight list.

THE CANADA METAL COMPANY LIMITED

721 EASTERN AVE., TORONTO 8 HO. 5-4684

Contact our nearest Branch

MONTRÉAL SCARBOROUGH WINNIPEG CALGARY VANCOUVER

For further information mark No. 117 on Readers' Service Card

TEFLON*

sheet...rod...tubing...
molded or machined parts?

You can get just what you want
from

JOHN CRANE



"Made of Teflon by JOHN CRANE" has become practically a standard specification for parts and components subject to severe electrical, corrosive, thermal, mechanical or atmospheric abuse. Whatever your requirements in Teflon . . . sheet, rod, tubing, packings, gaskets, bellows, insulators, sealing discs or non-stick parts . . . "John Crane" can supply them!

In addition, you get these important *plus* factors: complete uniformity throughout, high density control, freedom from flaws and rigid adherence to your specifications.

Request full details. Crane Packing Company, Ltd.,
Box 134, Station C, Dept. ATP, Hamilton, Ontario.



CRANE PACKING COMPANY, LTD.

OFFICES IN PRINCIPAL CANADIAN CITIES

For further information mark No. 122 on Readers' Service Card

DESIGN ENGINEERING APRIL 1961

**SMALLER - LIGHTER - STRONGER
ARROW-HART Appliance Switches**



**A COMPLETE
RANGE**

For vacuum sweepers, fans, power tools, etc., and radio and electronic equipment.



*Send for your free
copy of our new
catalogue Z-10*



ARROW-HART & HEGEMAN (CANADA) LIMITED

Industry Street, Toronto 15, Ontario.

7365 Mountain Sights, Montreal, Quebec.

Representatives: Cochrane Stephenson (Western) Ltd., Winnipeg, Calgary, Edmonton, Vancouver • George C. Robinson, Saint John, N.B.

For further information mark No. 101 on Readers' Service Card

AUTO-PONENT®

**HYDRAULIC
FULL FLOW VALVES**



Pat. #2,841,174

A complete line: 1/8", 1/4", 3/8", 1/2", and 3/4" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical Tube Sizes on special order.

MINIMUM PRESSURE DROP AND POWER LOSS . . . Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.

EASY FLOW ADJUSTMENTS under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.

SENSITIVE, CHATTERLESS BALL CHECK . . . Patented design insures rapid ball movement to open or close at low differentials.

FORGED BODIES permit higher pressures with wide safety margins. Aluminum—3000 psi; Steel and Stainless Steel—5,000 psi. Pressure ratings based on better than 5 to 1 safety factor. All internal parts are Stainless. Write for illustrated catalog.

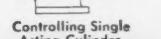
TYPICAL APPLICATIONS



Controlling Double Acting Cylinder



Two Direction Control



Close Connection



Controlling Single Acting Cylinder



Model F Standard Flow Control Valve or Model M Nozzle Valve



Model KF Knob and Dial Flow Control Valve or Model M Nozzle Valve



Model C Check Valve for In-Line Mounting



**2953 GRANT STREET
BELLWOOD (Chicago Suburb) ILLINOIS**

For further information mark No. 104 on Readers' Service Card

Editorial

Instruments and automation . . .

handmaidens of the progressive design engineer

This is the age of automation. Whether we like it or not, it's here, and it's here to stay.

Much is being said these days, and we suspect that much more will be said in the future about the dire effect that automation is having on employment. We will concede one point without argument — many of the manual workers, those men and women who earned a living by the skills of their hands and the sweat of their brows — have been displaced by machinery. Their jobs no longer exist; their work is being done more efficiently by machinery. But is this any reason to condemn automation?

For this one entry to be made on the debit side of the ledger there are hundreds that are being made every day on the credit side. Take for instance, the story carried in the February 27 issue of the C-I-L Contact, an employee newspaper. It reads like this:

"Charlie sighted down the alley, bowled the ball, and returned happily to record his strike. 'Automation?' he asked. 'Don't know much about it, except machines end up doing the work of people.'

Then he watched the automatic pinsetter do its job — and the alley was ready for the next bowler. 'See. Pin boys used to do that and now they're out of a job.'

What Charlie forgot was that previously there was almost always a shortage of pin boys; that many worked slowly; that others were so inaccurate that balls passed right between the pins.

The effect was that bowling as a sport expanded slowly — until the advent of the automatic pinsetters. Now scores of new alleys are springing up across the country. Automation has helped make it possible for anyone to bowl at anytime, mothers at noon, children after school, families in the evening, and at reasonable price.

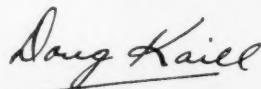
The total result has been an impressive growth in employment in the bowling industry itself, bearing out the long-range viewpoint about the effects of automation held by many in industry and labor."

Automation has indeed made these — and many other wonderful things possible. It has given us automatic appliances for the home — mother can bowl without worrying about the roast in the oven at home. She knows her automatic range will take care of it. Father can bowl without worrying about rushing home to stoke up the fires. The automatic furnace solved that problem long ago.

What has been said about the bowling industry could be said about a myriad of other industries. We'll refer to just one . . . plastics. Without modern automation — instruments and process control — we would never have known all the wonderful advantages that the plastics industry has brought us. No multitude of workers, even if trained and skilled to the *n*th degree, could begin to produce the poundages of plastics that modern living demands.

We owe much to the men and women who have pioneered, and are still researching the development of the tools of automation. These are usually referred to as 'instruments and controls'.

To their two associations in Canada, the Industrial Instrument Manufacturers Association, and the Instrument Society of America, we hasten to add that the job is far from complete . . . the lack of knowledge about instruments and automation in Canada is almost unbelievable. The gospel of automation has still to be preached, and taught.



**Use these
cards to get
additional
information...
promptly...
conveniently**

Every advertisement, new product, and catalogue listed in this issue of DESIGN ENGINEERING has been key numbered.

To secure information and literature just circle the proper number on the cards . . . complete and mail . . . we contact the companies for you and pay all the postage.

There are three identical cards . . . pass this copy on so your friends can order material of their choice, too.

**This service
is FREE . . .
make the
most of it.**

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada



Design Engineering

481 University Avenue

Toronto 2, Canada

Design Engineering

April 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371
 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

Design Engineering

April 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371
 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

Design Engineering

April 1961

Please send me more information on the following circled items:

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317
 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353
 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371
 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389

PLEASE PRINT or TYPE

CARD INVALID WITHOUT COMPANY NAME

Name Position

Company

Address

Products manufactured

Send DESIGN ENGINEERING for 1 year (\$5) or 2 years (\$9) and bill me later.
 Outside Canada rates: Great Britain & USA \$10 per year—Other countries \$20 per year
 (remittance with order). Please initial

ADVERTISERS' INDEX

Key No.

Page No.

A
 101 Arrow-Hart & Hegeman (Canada) Ltd. 89
 102 Atlas Steels Ltd. 22
 103 Automatic Electric Sales (Canada) Ltd. 18
 104 Auto-Ponents Inc. 89
 105 Avery Adhesive Label Corp. (Canada) Ltd. 87
 106 Aviation Electric Ltd. 83
 107 Bach-Simpson Ltd. 21

B
 108 Barden Corp., The 46
 109 Bellows-Balvair Ltd. 4
 110 Bristol Company of Canada Limited, The 29
 111 Brook Electric Motors of Canada Ltd. 82
 112 Brown, David-Foote Gears Ltd. 73
 113 Bruning Co., Ltd., Charles 69
 114 Buchanan Electrical Products Corp. 82

C
 115 Canadian General Electric Co. Ltd. 8, 9, 10, 11
 116 Canada Illinois Tools Inc. — Shake-proof/Fastex Div. 14
 117 Canada Metal Co. Ltd. 89
 118 Canadian SKF Co. Ltd. 85
 119 Carson Instruments Ltd. 6
 120 Clapp & Polikoff Inc. 12, 13
 121 Controls Company Canada Ltd. 30
 122 Crane Packing Co. Ltd. 89
 123 Cresswell Pomeroy Ltd. 78

D
 124 Deloro Stellite Ltd. 28
 125 Dominion Fasteners Ltd. 24, 25
 126 Dominion Magnesium Ltd. 77
 127 Donald Ropes and Wire Cloth Limited 74
 128 Dow Corning Silicones Ltd. 19, 20
 129 Du Pont of Canada Ltd.—Elastomers 38
 130 Du Pont of Canada Ltd.—Photo Products 40

F
 131 Fischer Bearings Manufacturing Ltd. 39
 132 Fischer Bearings Manufacturing Ltd. 41
 133 Flexonics Corp. of Canada Ltd. 85

G
 134 Garlock of Canada Ltd. 31
 135 Gates Rubber of Canada Ltd. 15

H
 136 Heim Co. 36
 137-140 Honeywell Controls Ltd. 32
 141 Hoover Co. Ltd., The I.P.C.

I
 142 International Business Machines Company Limited 16, 17
 144 International Nickel Co. of Canada Ltd. 35

M
 145 Measurement Engineering Ltd. 87
 146 Mechanite Metal Corp. 75
 147 Minnesota Mining & Manufacturing of Canada Ltd. 33
 148 Morse Chain of Canada Ltd. 34

N
 149 National Industrial Production Show 77
 150 Nichols, R. H. Ltd. 80
 151 Noranda Copper & Brass Ltd. 37
 152 Northern Electric Co. Ltd. 23

P
 153 Peacock Brothers Ltd. 27
 154 Polyenco Inc. 77
 155 Precision Rubber Products (Canada) Ltd. 79

R
 156 Raybestos-Manhattan (Canada) Ltd. 85
 157 Robbins & Myers Co. of Canada Ltd. 79
 158 Rousseau Controls Ltd. 42

S
 159 Simmons Fastener Corp. 87
 160 Smith & Stone Ltd. 72
 161 Standard Tube & T.J. Ltd. 2

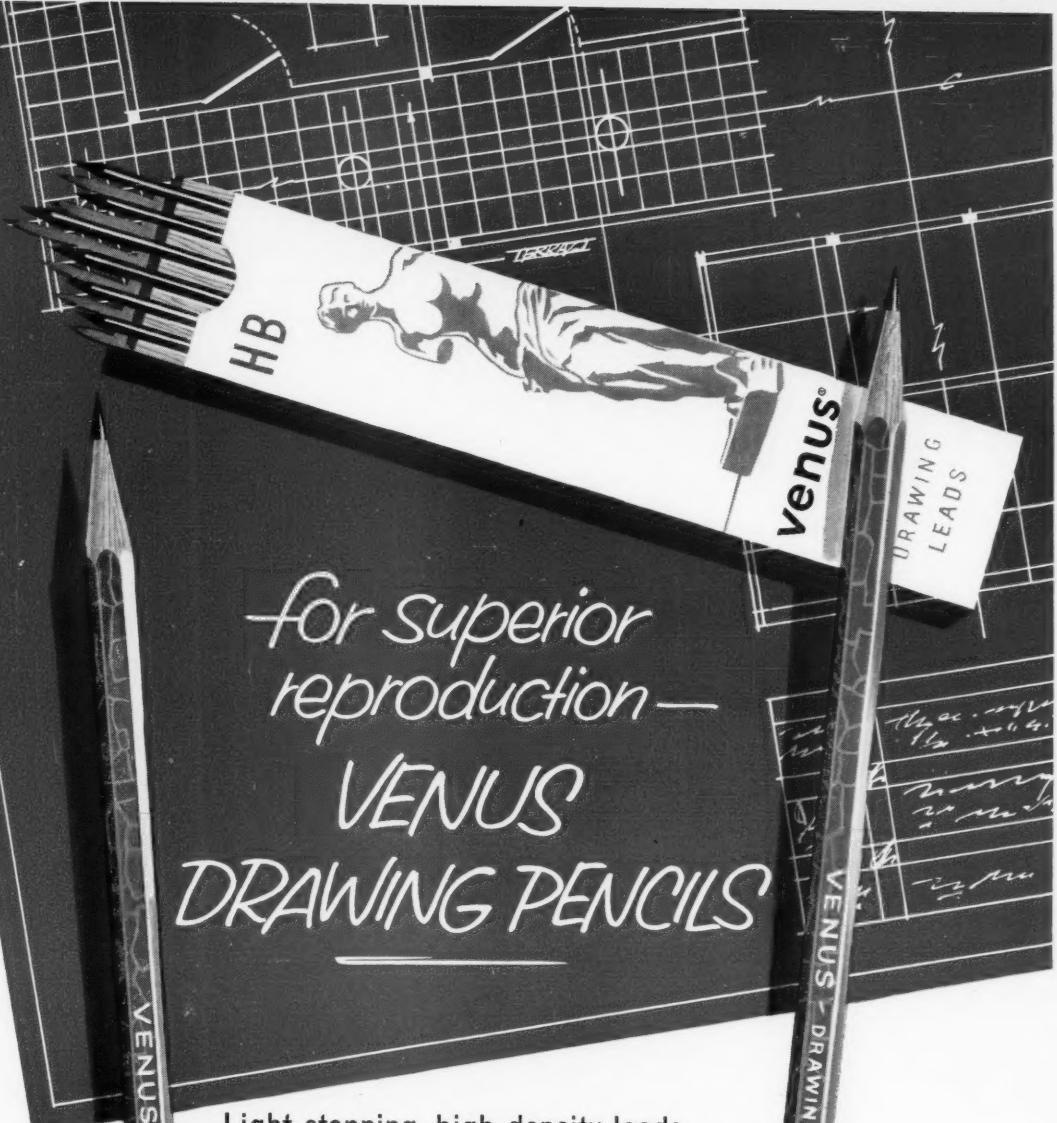
T
 162 Stone Franklin of Canada Ltd. 84
 163 Steel Co. of Canada Ltd. 43
 164 Stevenson & Company Limited, James 80
 165 Struthers-Dunn Div.—Renfrew Electric Co. Ltd. 72

T
 166 Thermo-Electric Canada Limited 74
 167 Thermovolt Instruments Ltd. 87
 168 Timkin Roller Bearings Co. O.B.C.
 169 Torrington Co. Ltd., The 44

U
 170 United Electric Controls (Canada) Ltd. 80
 171 United Shot Machinery Co. of Canada Ltd. 6
 172 United Steel Corp. Ltd. 70

V
 173 Veedar-Roof of Canada Ltd. 26
 174 Venus Pencil Company Limited I.B.C.

W
 175 Wallace Barnes Co. Ltd., The 45



*for superior
reproduction—*

VENUS DRAWING PENCILS

Light-stopping, high-density leads . . .

Blueprint, xerography, diazo, photography. No matter what process is used to reproduce your drawings, if they're Venus made, you'll get crisper, clearer prints. And because Venus leads are densely packed with the world's finest ground graphite, only very light pressure is required to apply a clean, opaque line on any material you use. Saves you time and effort. Venus drawing pencils come in 17 degrees of hardness. Draftsmen's leads and holders are also available.

Send for free samples in your favourite degrees of hardness.

VENUS PENCIL COMPANY LIMITED

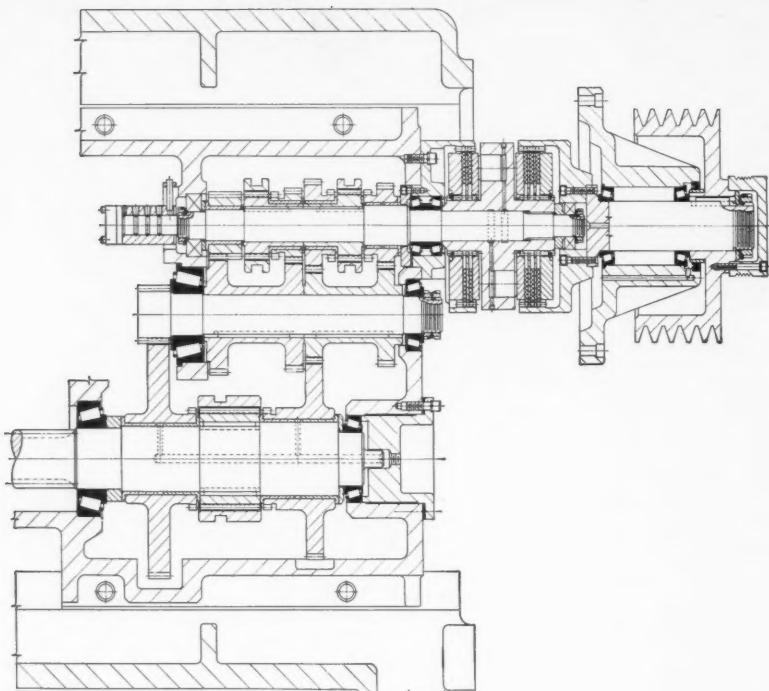
1325 The Queensway, Toronto 14, Ontario



DEMONSTRATES ITSELF

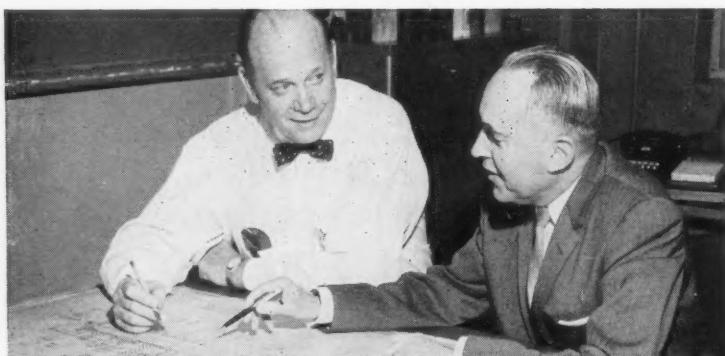
For further information circle No. 174 on our Readers' Service Card

Bullard fully powered vertical turret lathe uses Timken bearings to maximize production

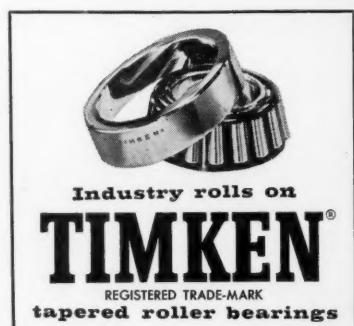


When designing their Dynatrol® Vertical Turret Lathe, Bullard engineers' aim was to increase machine speed and output economically. Dynatrol provides single lever or remote control of all head motions, traverse and feed engagement. And Timken tapered roller bearings at vital points—table radial position, head-

stock, clutch shaft, input pulley, rail raising bracket—provide the load-carrying capacity under varying loads and speeds that assures maximum production. Their taper lets Timken bearings take *any* combination of radial and thrust loads. And precision manufacture of Timken bearings assures high precision in the machine.



ENGINEERING SERVICE THAT SAVES YOU TIME AND MONEY. Working with you at the design stage, our sales engineers can often solve your bearing problems on the spot. From the wide range of Timken bearing sizes, types and precisions they can help you select the Timken bearings to give you the maximum in efficient, economical design engineering.



Canadian Timken, St. Thomas, Ontario, Canada. Division of The Timken Roller Bearing Company. Timken bearings manufactured in Canada, Australia, Brazil, England, France and U.S.A.

